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Original Research Article

An Examination of the Functional Results in Intertrochanteric Femur Fractures Managed with Proximal Femoral Nail Treatment

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Conflict of interest: Nil

Abstract

Background: One of the most frequent hip fractures, particularly in the elderly with osteoporotic bones, is an intertrochanteric femur fracture, which is typically the result of little trauma. Many people still believe that the Dynamic Hip Screw (DHS) is the best option for treating intertrochanteric fractures. In older adults, intertrochanteric fractures are rather prevalent; in younger adults, they are less common. Coxa-vara deformity is commonly encountered in conservatively treated intertrochanteric fractures that healed with vicious callus, resulting in lower limb flaccidity and shortening. A relatively recent implant used to treat unstable intertrochanteric fractures is the proximal femoral nail. The most common fracture type that requires surgery and has the greatest rate of postoperative mortality among all medically treated fractures are trochanteric fractures, which are incapacitating injuries that primarily affect the elderly.

Aim: Aim of this study is to evaluate functional outcomes in intertrochanteric femur fractures treated by proximal femoral nailing.

Material and Method: The Department of Orthopedics is the site of the current prospective non-controlled, non-randomized, non-blinded study. This study had 100 fracture patients in total. Age, sex, the mechanism of injury, and the kind of fracture pattern, as classified by Boyd and Griffin, are among the data gathered. Pelvic radiographs were used to check and study the patients. In every instance, the afflicted limb received skin traction. The medullary size and neck-shaft angle were measured. Traction, internal rotation, and adduction or abduction as needed were the main methods used to achieve the decrease. Nail reduction was used when the nail was placed in the proximal fragment and reduction was accomplished by rotational motions and compression by the nail if traction and manipulation were unable to produce reduction.

Results: Out of 100 patients, 34 (32.65%) were females and 66 (67.35%) were males. The Age group ranged from 18 to 85 years. 43 patients (40.81%) were between the 60 to 70 yrs age group. 57 (56.12%) patients had stable fractures and the rest (43.87%) had unstable fractures. We found complications in this study which were seen as follows Inadequate reduction in 23 cases, Failure to insert the de-rotation screw in 8 cases, Difficulty in distal locking in 10 cases, Varus deformity in 5 cases, Shortening in 5 cases, Superficial infection in 12 cases, Implant failure in 6 cases, Z-effect in 20 cases & Malunion in 11 cases.

Conclusion: The current study concludes that, although being a technically complex surgery needing specialized instrumentation, Proximal Femoral Nailing is a dependable implant that produces consistent and repeatable results, even in unstable intertrochanteric femur fractures at any age. In the fixation of all kinds of intertrochanteric fractures, it needs to be promoted. PFN is an effective and minimally invasive surgical method that is used as a dependable fixation device for all trochanteric fractures in the elderly following sufficient fracture reduction. PFN also has a few side effects that can be averted by persistently creative thinking in PFN treatment.

Keywords: Proximal femoral fractures, Proximal femoral nail, Internal fixation and Complications.

Introduction

One of the most frequent hip fractures, particularly in the elderly with osteoporotic bones, is an intertrochanteric femur fracture, which is typically the result of little trauma. Some of the most important variables to take into account for the

effective treatment of these fractures are the patient's age, osteoporosis, overall health, and related co-morbidities. [1,2] There are numerous kinds of implants that can be fixed. The optimal internal fixation device should allow for the earliest possible patient mobilization without compromising fracture reduction, stability, or union. Because of its biomechanical benefit, intramedullary fixation devices have grown in popularity recently. Since trochanteric fractures are the most severe injuries across all age groups and have become more common in recent years as a result of the aging population, they are of global interest. [3] Hip fractures are expected to double in frequency globally by 2025, reaching 2.6 million cases, and 4.5 million cases by 2050. Asia accounted for 26% of all hip fractures in 1990; by 2025 and 2050, this percentage may have increased to 37% and 45%, respectively. [4] At fifty years of age, the reported lifetime risk of hip fracture is twenty percent for women and five percent for males. [5]

Intertrochanteric fractures have been treated by a variety of surgical techniques using a variety of implants, as documented in the literature. Because these fractures originate from porous bone with a great and rich blood supply and have the potential to heal on their own without active intervention, it's probable that little attention has been paid to them in the past. Conservative therapy, on the other hand, led to a high death rate from complications when lying down and protracted immobilization, as well as a vicious callus with varus and external rotation with shortening resulting in the short limp gait of walking. Restoring the pre-injury state as closely as feasible is the aim of treatment for intertrochanteric fractures. As a result, there is an internal obsession with enhancing patient comfort through nursing care facilitation, hospitalization reduction, early mobilization, and complications reduction. The instability and fixation issues that arise from treating intertrochanteric fractures present challenges in treating this fracture. An internally connected fracture is said to be stable if it can resist the forces of gravity and surrounding muscles without experiencing a varus displacement of the fracture. Other extrinsic contributing factors, such implant selection and insertion technique, as well as some intrinsic factors, like fracture reduction and osteoporosis, may also play a major role in fixing failure. [6] An rising number of elderly people with osteoporosis has been linked to an increase in the incidence of intertrochanteric fractures. By 2040, this incidence is expected to double. Numerous research have been conducted about the management of intertrochanteric fractures. Treatment techniques, both surgical and non-surgical, have been thoroughly investigated. Non-operative management has been reported to result in higher rates of malunion and nonunion in elderly patients, which in turn increases the patients' morbidity and death. Non-operative treatment is deemed appropriate for those non-ambulators who have little pain following an accident. Additionally, it has been noted that the morbidity and mortality rates are decreased when these elderly individuals are mobilized quickly. These fractures were rare in the younger age group, but they are becoming more common presently, caused by high-energy trauma, and they are frequently connected to other fractures in the younger population. [7,8] These implants are becoming widely accepted in the treatment of unstable intertrochanteric fractures, despite being technically complex surgical procedures. The benefits of these implants include minimal blood loss, hematoma preservation, and small exposure for insertion. [9,10] Considering the advantages of PFN the present study was carried out to know the functional outcome of the patients treated by the same.

Material and Methods

The present study is a prospective non-controlled, non-randomized, non-blinded study conducted at the Department of Orthopedics. A total of 100 cases of fracture were included in this study. Data collected include age, sex, mechanism of injury, and type of fracture pattern according to Boyd and Griffin's classification. Patients were examined and investigated with radiographs of the pelvis. Skin traction was applied to the affected limb in all cases. Neck-shaft angle and medullary size were assessed. The reduction was achieved primarily by traction and internal rotation, and adduction or abduction as required. If reduction was not achieved by traction and manipulation, nail reduction was done where the nail was introduced in the proximal fragment, and reduction was achieved by rotational movements and compression by the nail.

Inclusion Criteria

- A total of 100 patients with intertrochanteric fractures who were admitted to the outpatient and emergency department of orthopedics were included in the study.
- Patients of either sex and closed fractures were included.

Exclusion Criteria-

1. Pathological fractures.
2. Polytrauma.
3. Patients with co-morbid conditions like stroke that may hinder rehabilitation

All patients were operated on within 10 days of the occurrence of the fracture after a complete pre-anesthetic evaluation. Injection cefuroxime 1.5 gram was administered half an hour before surgery.

Operative Technique: The PFN we used had a standard configuration with a length of 36 to 42 cm, mediolateral angulation of 6°, and neck shaft angle of 135°. The nail had a proximal diameter of 15 mm and distal diameter of 9 to 12 mm we used a proximal derotation of 6.2 mm and a distal lag screw of 8 mm distal locking was done with 4.9 mm cortical screws both in static and dynamic mode. Patients were operated on a standard radiolucent fracture table under spinal or general anesthesia according to the condition of the patient. Fractures were reduced by longitudinal traction and the limb was placed in slight adduction to facilitate nail insertion. The reduction was done. Harris hip score was collected using a pre-designed Performa by the principal investigator. Confounding variables as well as bias were controlled by strictly following the exclusion criteria. Data were entered and analyzed through Statistical Package for Social Sciences (V-17).

The incision was made 5 cm cranial to the tip of the greater trochanter. The entry point was made at the tip of the greater trochanter in its midpoint with a curved awl with image intensifier guidance. Than 2.8 mm guide wire was inserted. Serial reaming was done. The proximal 7 cm of the femur was reamed up to 15 mm. After mounting the appropriate-sized nail on the insertion device the nail was introduced manually. Two guide pins were then passed up to 5 mm below the subarticular surface for derotation and compression screw which were introduced after reaming in a sequential manner. The distal locking was done with the freehand technique. Intravenous antibiotics were given for the first 72 hours followed by oral antibiotics for the next 5 days. In all cases, antithrombotic prophylaxis was given using low molecular weight heparin. Static quadriceps mobilization exercises were started on 2 nd day. Partial weight bearing with axillary crutches as soon as possible. Sutures were removed on the 14th postoperative day. Protein and caloric nutrition, especially osteoporotic therapy, is important for successful recovery. Tablet risedronate 35 mg once weekly for 6 months was given at the end of the 2nd week along with calcium supplementation of 60000 IU weekly for 12 weeks. Partial weight bearing was started at about 4th week. Patients were followed up at intervals of 6, 12, 18, and 24 weeks. Full weight-bearing walking was allowed after assessing for the radiological and clinical union. All patients had a minimum follow-up of one year.

Statistical Analysis: Mean and standard deviation was computed for the quantitative variable i.e., age. Frequency and percentage were calculated for qualitative variables like gender, mode of admission, type of fracture, and functional outcome (Excellent to poor). Effect modifiers were controlled by stratification of age, gender, type of fracture, and mode of admission to observe the effect of these modifiers on the outcome by using the chi-square test, and p value≤0.05 was considered significant.

Result

Out of 100 patients, 34 (32.65%) were females and 66 (67.35%) were males. The Age group ranged from 18 to 85 years. 43 patients (40.81%) were between the 60 to 70 yrs. age group. 57 (56.12%) patients had stable fractures and the rest (43.87%) had unstable fractures.

Table 1: Distribution of cases according to age

Age in years	No. of patients (%, n=100)
18-30	04 (4.12%)
31-40	10(10.2)
41-50	09(9.18%)
51-60	15(15.3%)
61-70	41(40.81.%)
71-80	17(16.32%)
81-90	04(4.08%)
Total	**100 (100%)**

Table 2: This table shows the distribution of cases according to complication

Complication	Number of cases
Inadequate reduction	**23**
Failure to insert de-rotation screw	**8**
Difficulty in distal locking	**10**
Varus deformity	**5**
Shortening	**5**
Superficial infection	**12**
Implant failure	**6**
Z-effect	**20**
Malunion	**11**
Total	**100**

We found complications in this study which were seen as follows Inadequate reduction in 23 cases, Failure to insert the de-rotation screw in 8 cases, Difficulty in distal locking in 10 cases, Varus deformity in 5 cases, Shortening in 5 cases, Superficial infection in 12 cases, Implant failure in 6 cases, Z-effect in 20 cases & Malunion in 11 cases.

Table 3: Distribution of cases according to functional results in the present study: (According to modified Harris hip score)

Clinical results	Total points	No. of Patients (%, n=100)
Excellent	81-100	31 (30.6%)
Good	61-80	44 (44.9%)
Fair	41-60	15 (14.2%)
Poor	<40	10 (10.2%)
Total		**100 (100%)**

The excellent outcome was seen in 31 (30.6%) patients, the good outcome was found in 44 (44.9%) patients, the fair outcome was found in 15 (14.2%) patients, and the poor outcome was found in 10 (10.2%) patients. In our, study we found intraoperative complications in 13 cases. Loss of anatomical reduction occurred in two cases during the procedure. In one case it occurred at the time of proximal reaming and the second at the time of insertion of the nail.

Discussion

For the trauma surgeon, intertrochanteric fractures pose a serious challenge. Poor surgical technique can result in the failure of primary fixation when fixing unstable proximal femur fractures, as the procedure is often technically challenging. There is ongoing debate concerning the optimal course of care for these fractures. Although DHS fixation is generally recommended, up to 20% of cases still result in fixation failure. [11] Osteoporosis, lack of anatomic reduction, implant failure, fracture instability, and improper lag screw placement in the femoral head that results in the screw being cut out are common reasons of fixation failure. [12] Older adults have better tolerance for less invasively implanted intramedullary implants. PFN has several benefits, including the ability to reduce the moment arm, the ability to do the procedure under closed conditions, and the preservation of the fracture hematoma—a crucial factor in the healing of fractures. Additionally, it lessens the chance of infection, blood loss, soft tissue dissection, and problems from open wounds. [13]

Developed in 1996, the PFN is a successful intramedullary load-sharing tool. It integrates the locked intramedullary nail, dynamic hip screw, and zickel nail's theoretical benefits. The DHS has a larger moment arm, which puts a great deal of stress on weight-bearing and increases the risk of varus malunion and lag screw cut out. In contrast, the biomechanically stiffer PFN has a shorter moment arm, or the distance from the tip of the lag screw to the center of the femoral canal. The nail is made more rigid by the bigger proximal diameter (15 mm) of PFN. It has been demonstrated that intramedullary devices are biologically stronger and have the capacity to tolerate higher static and multiple times higher cyclical loading. [14] PFN acts as a buttress in preventing medialization of the shaft so the fracture heals without primary restoration of the medial column as the implant compensates for it. [15]

Domingo et al. 2001 [16] conducted a study on 295 patients for intertrochanteric fracture fixation with PFN and obtained overall results were comparable with those of other fracture systems, authors assert that technically surgery is not complex and the numbers of recorded complications were acceptable. The intraoperative variables and the systemic complications were similar to those encountered by other devices. [11] Uzun M et al 2009 [17] evaluated radiographic complications occurring after treatment of unstable intertrochanteric hip fractures with the Proximal Femoral Nail (PFN) and their effect on functional results in 35 patients.

The Harris hip score results were excellent in 11 patients (31.4%), good in 15 patients (42.9%), and fair in seven patients (20%). The functional outcome after intramedullary PFN was also studied by Sachin S et al 2018 [18] and Asad K et al 2019 [19] The modified harris hip score was excellent at 24.4% and 28.6% respectively. A good score was seen in 42.2% and 45.1% respectively along with a poor score seen in 13.3% and 9.9% of the patients respectively. The modified Harris score in the present study was comparable to the above-mentioned studies.

Kushal et al.2018 [20] in the study of 52 patients noted that in the DHS group, excellent results were seen in six (23%), good results were seen in five (19%), fair results were seen in 13 (50%), and poor results seen in two (8%). In the PFN group, excellent results were seen in four (15%), good results were seen in 14 (54%), fair results were seen in seven (27%), and poor results were seen in one (4%). Harish et al.2019 [21] in the study of 30 patients noted that in the DHS group, excellent results were seen in six (50%), good results were

seen in two (13.33%), fair results were seen in two (13.33%), and no poor results were seen.

Although PFN's cost may be a deterrent for some, it is an effective treatment for intertrochanteric fractures, especially those with an unstable pattern. PFN results in less blood loss since it needs a smaller incision and less dissection of soft tissue. It is a load-sharing device, and because of its shorter lever arm, the implant is under less tensile strain, which lowers the risk of implant failure.[22] serves as reinforcement by preventing the medialization of the shaft; as a result, a damaged lateral wall is not at risk.

Conclusion

The current study concludes that, although being a technically complex surgery needing specialized instrumentation, Proximal Femoral Nailing is a dependable implant that produces consistent and repeatable results, even in unstable intertrochanteric femur fractures at any age. In the fixation of all kinds of intertrochanteric fractures, it need to be promoted. PFN is an effective and minimally invasive surgical method that is used as a dependable fixation device for all trochanteric fractures in the elderly following sufficient fracture reduction. PFN also has a few side effects that can be averted by persistently creative thinking in PFN treatment.

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