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Case Series

Functional evaluation of unstable intertrochanteric fractures treated with proximal femoral nailing

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ABSTRACT

In this study the functional outcome of proximal femoral nailing (PFN) in patients with unstable intertrochanteric fractures is studied and outcome is assessed with Modified Harris Hip Score. A post-operative analysis of unstable intertrochanteric fractures treated with PFN is done for its functional assessment. Various national & international studies are taken into consideration and our institutional study is compared with them. Between September 2020 to March 2022, 20 patients with unstable intertrochanteric fractures of the hip joint who were operated with PFN were functionally and clinically evaluated as per the Modified Harris Hip Score. Patients who satisfied the inclusion criteria were included in the study and follow-up was done up to 9 months. Fracture pattern, operative details and post-operative complications were documented. This study of 20 patients of unstable intertrochanteric fractures fixed with PFN showed excellent results in 9 patients (45 %), good functional outcome in 6 patients (30 %) and fair functional outcome in 3 patients (15 %). 2 patients showed a poor outcome accounting for 10%. The study showed that PFN is a reliable and effective device for the treatment of unstable intertrochanteric fractures. It provides a satisfactory fixation, but success is dependent mainly on fracture type, bony architecture, operative technique, postoperative care and rehabilitation. In view of the fewer post-operative complications, early union of fracture, early weight bearing and early return to work, we concluded the PFN to be a versatile, stable and acceptable implant in fixation of unstable intertrochanteric fractures which leads to a better functional outcome.

Keywords: Proximal femoral nail, Modified Harris hip score, Intertrochanteric fracture, Hip joint

INTRODUCTION

Intertrochanteric fractures are defined as extracapsular fractures of the proximal femur that occurs between the greater and lesser trochanter. The intertrochanteric aspect of the femur is located between the greater and lesser trochanters and is composed of dense trabecular bone.[1] They are common in elderly and osteoporotic people, most of the patients are women in the 8th decade.[2] They account for nearly 50% of all fractures in the proximal femur. The ratio of women to men ranges from 2:1 to 8:1, likely because of postmenopausal metabolic changes in bone. Some of the factors associated with intertrochanteric fractures include advancing age, increased number of comorbidities, increased dependency in activities of daily living, and a history of other osteoporosis related fractures.[3] Intertrochanteric fractures are classified as stable and unstable on the basis of involvement of the posteromedial cortex. They are almost always treated by early internal fixation. Non-operative treatment is not indicated. The main aim of surgery is to mobilize the patient early. It is crucial to use an implant that is minimally invasive, allows early weight bearing, and has low complication rates.[4] The types of implants used in these fractures have been divided into extramedullary implants and intramedullary nails. The choice of implant

is mainly determined by the fracture pattern (stable or unstable). Unstable intertrochanteric fractures are those with major disruption of the posteromedial cortex because of comminution or are fractures with reverse oblique patterns or fractures with subtrochanteric extension. Fractures without posteromedial cortex disruption or subtrochanteric extension are considered stable.[5]

The dynamic hip screw is a good option for treatment of stable intertrochanteric fractures.[6] However, for the treatment of unstable intertrochanteric fractures, its role remains controversial.

Intramedullary devices such as Gamma nail or proximal femoral nail and proximal anatomical femur plates are in use for the treatment of unstable intertrochanteric femur fractures.[7] It has been shown that the proximal femoral intramedullary nail provides more stability and allows for earlier weight bearing than the locking plate when used for the treatment of unstable intertrochanteric fractures of the femur.

There is still a lot of confusion regarding the best implant for these type of fractures with minimum complications so in this study we clinically and radiologically evaluate the treatment of unstable intertrochanteric fractures of the femur treated with proximal femoral nailing so that we may augment the findings of previous studies and provide a more scholastic conclusion on the outcomes of using Proximal femoral nailing for unstable intertrochanteric fractures.

CASE SERIES

This prospective study includes twenty patients of unstable intertrochanteric fractures treated with PFN. Each patient was subjected to clinical and radiological examination along with routine pathological investigations. Patient is subjected to radiological examination that includes taking X-rays of the affected side in both AP and lateral views. On the basis of the X-rays and clinical presentation, the fracture is subdivided into either a stable or unstable fracture using Evans classification. Pre-operative planning consists of determining the nail diameter by measuring diameter of the femur at the level of isthmus on an AP X-ray, determination of neck shaft angle: by measuring on the unaffected side on an AP X-ray using a goniometer and determining the nail length. After induction of anesthesia, the patient was placed in the supine position on the fracture table with the affected limb in adduction of 10-15 degrees and closed reduction of the fracture was achieved with traction and rotation.[10]

In cases where satisfactory reduction was not possible, open reduction was undertaken. The image intensifier was positioned so that simultaneous anterior-posterior and lateral views could be taken. A 5 cm longitudinal incision was taken proximal from the tip of trochanter and the fascia lata was opened in line with the incision. The gluteus medius was split in line with the fibers and the tip of the trochanter was exposed. Using a straight bone awl, entry point was made on the tip of the greater trochanter, being slightly lateral in AP view and centering in the lateral view. The awl is driven into the cancellous bone till the marrow is opened. Following this, the guide wire was passed through the same path into the marrow and guided across the fracture using a T handle under image intensifier. Over the guide wire, cannulated rigid reamer no.14 was inserted and manual reaming was done to accommodate the proximal end of the proximal femoral nail.

After confirming satisfactory reduction, an appropriate size nail as determined preoperatively was assembled to the insertion handle and inserted over the guide wire using gentle twisting movements of the handle till the 8 mm hip screw hole coincides with the inferior aspect of the neck in the image intensifier. Guide wires were inserted with the help of the aiming device tightly secured to the insertion handle and using the appropriate guide wire sleeves. A 1.8 mm guide wire was inserted through the sleeves after a stab incision for the 8 mm neck screw.

It was ensured that the sleeves approximate to the lateral cortex to avoid misdirection of the guide wires. The guide wire was positioned in the inferior aspect of the neck in AP view and in centre in the lateral view for the 8 mm hip screw. The guide wire was inserted 5 mm deeper than the planned screw size. Similarly, another guide wire was inserted through the proximal hole for insertion of the 6.5 mm derotation screw. Proper positioning of the nail aids in proper anteversion of the guide wires as there is inbuilt anteversion in the hole of the nail. The derotation screw is inserted first to prevent the possible rotation of the proximal fragment when inserting the hip screw.

Drilling is done over the guide wire using the 6.5 mm cannulated drill provided up to the previous length. The screw length is measured priorly and similar length guide wire was inserted. Length and position were confirmed under the image intensifier before the guide wire was removed. Using an 8mm cannulated drill, the neck was opened over the guide wire up to the desired length and tapping was done. The appropriate 8 mm hip screw was inserted. The final position was confirmed under the image intensifier.

Distal locking is usually performed with 4.9 mm locking bolts. Traction is released to achieve compression at the fracture site. The drill sleeve system was inserted with a stab incision through the aiming device. Drill holes were made with a 4 mm drill bit through both cortices. Length was measured directly from the drill marking. Locking bolt was inserted through the sleeve and confirmed under image intensifier.

After the completion of the fixation, thorough wash of the wound was given with normal saline, wound closed in layers. Sterile dressing was applied, and compression bandage used. Sutures were removed on the 11th postoperative day. On post-op day 1, patients were

encouraged to sit in bed and were taught quadriceps strengthening exercises and knee mobilization. Toe-touch weight bearing with a walker/axillary crutch was advised for patients with stable fixation, depending on the patient's pain tolerance. Patients were advised partial weight bearing with help of walking aids at the time of discharge (2 weeks). All patients were followed up at 0,3, 6 and 9 months. At every visit, the patient was assessed clinically and radiologically.

There are twenty patients taken for this study. There were thirteen males and seven females with unstable intertrochanteric fractures. All fractures were closed fractures. Average age incidence in the present study was 59.50 years. Most cases occurred after a fall which was trivial in nature. Type IV fractures were more common. Average time to attain full weight bearing was 6 weeks. Out of the 20 cases evaluated using Harris Hip scoring at their last follow- up: 9 cases (45%) had excellent, 6 cases (30%) good, 3 cases (15%) fair and 2 cases (10%) had a poor score.

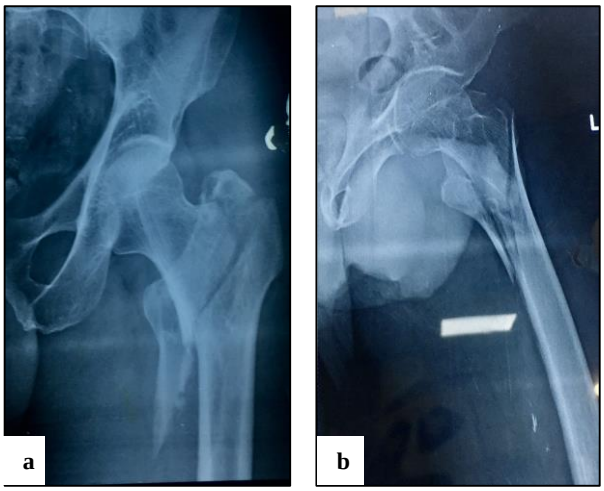

Figure 1: Pre-operative radiographs of intertrochanteric fracture: (a) AP (left) and (b) lateral (right).

Figure 2: Patient positioning.

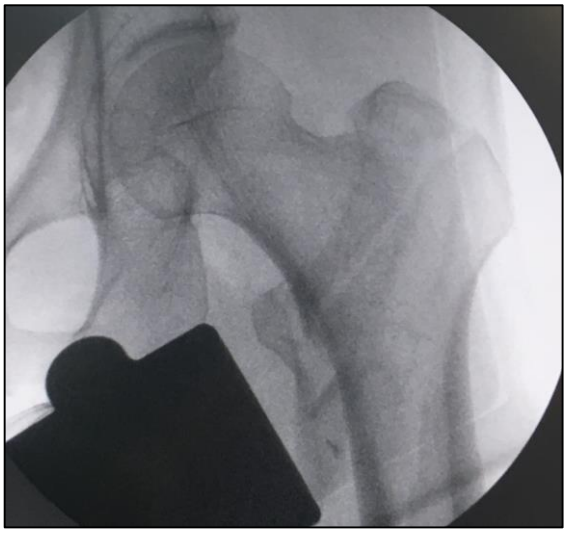

Figure 3: C-arm picture after fracture reduction.

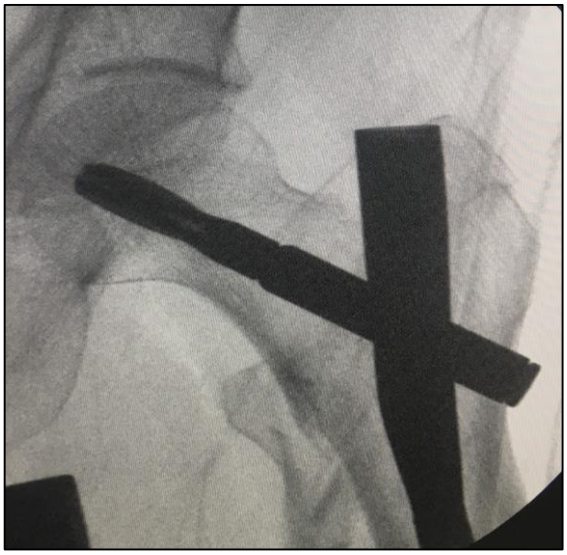

Figure 4: C-arm picture: fracture collapse achieved after reduction of traction.

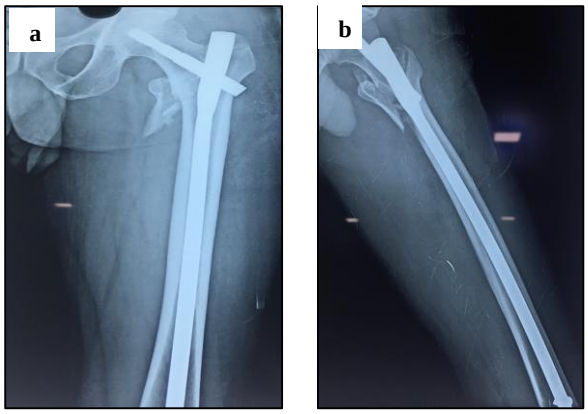

Figure 5 (a and b): Post -op X-ray: AP (left) and lateral (right).

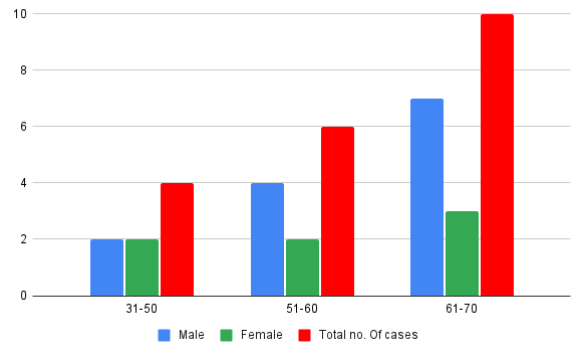

Figure 6: Distribution of sample by age groups and sex.

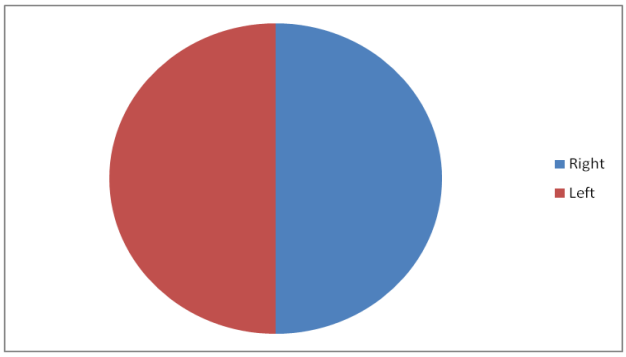

Figure 7: Distribution of sample by affected side.

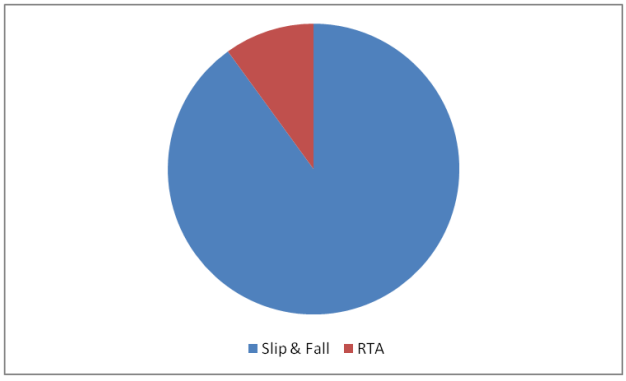

Figure 8: Distribution of sample by mode of injury.

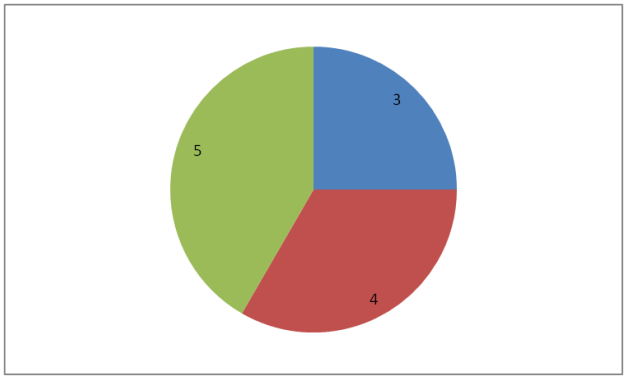

Figure 9: Distribution of sample by type of fracture according to Evans classification.

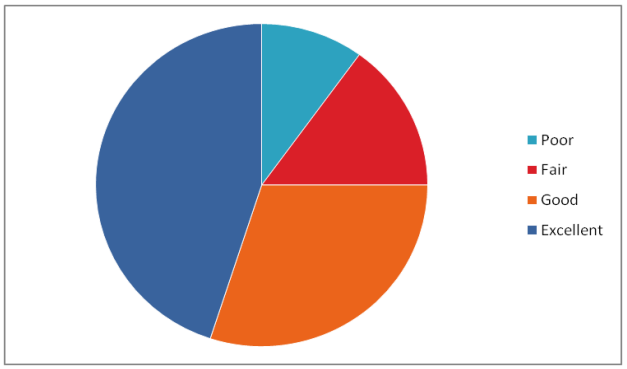

Figure 10: Distribution of sample by Harris hip score evaluation.

The following observations were made from data collected during the study. Intertrochanteric fractures of the right hip were affected in 10 patients and left hip in 10 cases. Significantly we find more cases occurring after falls (90%) than RTA (10%). We find more cases were unstable intertrochanteric fractures Type 4 (45%) in the present study when compared to types 3 and 5 (Figure 9).

DISCUSSION

The present study was done at the Malla Reddy Medical College for Women, Suraram, Hyderabad, Telangana during the period from September 2020 to March 2022. In the study a total of 20 cases of unstable intertrochanteric fracture of femur treated by using proximal femoral nails were evaluated. Patients admitted here were evaluated pre-operatively. Details were collected in a performed proforma, operated and followed up regularly on OPD basis.

The present study of patients with unstable intertrochanteric fractures is compared with Kumar et al study which was a retrospective study that evaluated the functional and radiological outcome of proximal femoral nail in the treatment of unstable intertrochanteric fractures, it included 45 patients, of which 3 patients died within 6 months of follow up; Hoffman et al study, which was a retrospective study that included 193 adult intertrochanteric femoral fractures (OTA/AO type 31 A3) who were identified with intramedullary nail fixation; Baral P et al study which consists of 100 traumatic cases of peri trochanteric fracture.[4,13,14] Cases lost to follow-up, deaths and incomplete functional outcome, intraoperative and postoperative data were excluded. Total of 71 cases were included in the study. It was also contrasted with other studies like Cummings et al, Pogrund et al, Koval et al, Boyd et al and Gallagher et al, studies.[15-19]

Mechanism of injury

In the present study, the mechanism of injury was due to road traffic accident in 2 patients (10 %) and slip and fall in 18 patients (90 %). In Hoffman et al study mechanism

of injury was due to road traffic accident in 43 patients (22.27 %) and trivial fall in 150 patients (77.72 %).[13]

In a retrospective study of 100 patients by Baral et al trivial fall on ground was the commonest mechanism of injury (63%).[14] Cummings et al listed the following four variables that could be responsible for this: Insufficient local shock absorbers, such as the muscle and fat surrounding the hip, and insufficient defensive reflexes to lower the energy of a fall below a specific critical level insufficient hip bone strength due to osteoporosis or osteomalacia.[15] Pogrund et al, reported that women with osteoporosis who fractured their proximal femur as a result of a fall were more likely to sustain an intertrochanteric hip fracture than a femoral neck fracture.[16] According to research by Koval et al, a simple fall causes 90% of hip fractures in the elderly. The most common cause of hip fractures in young adults has been found to be high energy trauma, such as falls from a height or vehicle accidents.[17] This shows that a low velocity injury such as a slip and fall is the common cause of this fracture.

Age of incidence

Unstable intertrochanteric fracture commonly occurred between the age group of 50 to 70 years. The youngest patient's age was 33 years and oldest patient's age was 70 years. The average patients' age was 59.50 years.

In Hoffman et al, study, patients' average age was 81 years, and the youngest patient's age was 19 years and the oldest patient's age was 96 years.[13] In Kumar et al study, the mean age was 61 and the youngest patient age was 35 years and the oldest patient's age was 90 years.[14] In a study by Boyd et al, 90% of the patients were above 50 years of age and the mean age was 69.7 years.[18]

In Gallagher et al study, the mean age was 79.25 and trochanteric fractures became more common in both sexes after the age of 80.[19] In 9th decade the risk of trochanteric fractures increased by 8 times in males, whereas in females they increased by 5 times. From this we can infer that unstable intertrochanteric fractures commonly occur in the elderly population.

Sex incidence

In this study, there are 13 male patients (65%) and 7 female patients (35%). In Kumar et al study also commonly affected are males 26 Patients (61.90%) compared to females 16 Patients (38.09%).

In Hoffman et al study males are less affected 80 Patients (41.45%) compared to females 113 patients (58.54%).[13] In Gallagher et al, study the ratio of female to male incidence of trochanteric fracture was 3:1. Females (76%) were more commonly affected than males (23%). It also showed that the risk of trochanteric fractures increased by 8 times in 9th decade, whereas in females they increased by 5 times in 9th decade.[19] In a study by Boyd et al 75.8% were females and 24.2 % were males.[18] Male predominance can be drawn from the present study.

Side of fracture

Amongst the 20 cases operated, 10 patients (50%) were found to have proximal femoral fractures on the left side and 10 (50%) patients were having fractures on the right side. In Kumar et al study right side was involved in 30 patients (71.42%) and left side in 12 patients (28.57%).[4]

Weight bearing

All the patients started knee and hip movements on the 2nd post operative day. Non -weight bearing walking with a walker was started within 1 week. The partial weight bearing was started at 2 weeks and full weight bearing at 6 weeks. In Hoffman et al study, weight-bearing was allowed as tolerated postoperatively and the average time for full weight bearing was 5 weeks.[13] In Kumar et al study the mean time for full weight bearing was 6 weeks.[4]

Complications

In the present study one patient (5%) developed implant failure due to Z effect and one patient (5%) developed malunion leading to a poor functional outcome. There were no cases with screw cut out, fracture below the tip of the nail, reverse Z effect and breakage of nail in between proximal screw and distal lock. In Hoffman et al study, twelve patients (6.2%) developed a nonunion with additional 6 fractures (3.1%) resulting in a malunion. Nine patients (4.7%) underwent a reoperation due to hardware or fixation failure with additional 2 patients (1.0%) diagnosed with avascular necrosis of the femoral head (AVFH) which were converted into total hip arthroplasties.[13] In total, 13 patients (6.7%) had to be treated by hemi or total hip arthroplasty. Fixation failure occurred in 8 patients (4.1%). two patients (1.04%) developed an avascular necrosis of the femoral head after nailing. In Kumar et al4 study 6 cases (14.2%) of intra operative lateral wall fractures were noted, out of which 2 cases developed secondary varus collapse of 5 degrees.

Skin complications

In the present study two patients (10%) developed superficial infection which was treated with local antibiotics and dressing was done as per necessity. In all the cases the wound healed in the end. There were no wound related complications noted in both Hoffman et al and Kumar et al studies.

Functional outcome

The functional outcome is measured according to Harris Hip score. In this study of total 20 patients of unstable intertrochanteric fractures fixed with proximal femoral nail showed excellent results in 9 patients (45 %), good functional outcome in 6 patients (30 %) and fair functional

outcome in 3 patients (15 %). 2 patients showed a poor outcome accounting for 10%. The advantage of using an intramedullary device is early mobilization of patients with unstable intertrochanteric fractures which improves the quality of life of the patient.

CONCLUSION

Hip fractures are a leading cause of morbidity and mortality, especially in the older population. Intertrochanteric fractures are a common injury usually resulting from a trivial fall. Hip fractures result in serious health issues and decreased quality of life thus causing the greatest number of deaths. Early operation on patients with unstable intertrochanteric fractures enhances the ability of patients to return to independent living and complications of prolonged immobilization are prevented. The study showed that proximal femoral nail is a reliable and effective device for the treatment of unstable intertrochanteric fractures.

Proximal femoral nail provides a satisfactory fixation, but success is dependent mainly on fracture type, bony architecture, operative technique, postoperative care and rehabilitation. The main advantage of using an intramedullary device is early mobilization of patients with unstable intertrochanteric fracture which improved the quality of life of the patient. The study showed Proximal femoral nail to be a versatile, stable, acceptable implant in fixation of unstable intertrochanteric fractures as it has fewer post operative complications, provides an early union of fracture, early weight bearing and early return to work thus leading to a better functional outcome.

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