

FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING FOR UNSTABLE INTERTROCHANTERIC FEMORAL FRACTURE IN PATIENT MORE THAN 60 YEARS OLD

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ABSTRACT

Background: Hip fracture include intertrochanteric fracture due to fall are one of the most common orthopedic problem in elderly, it is account about half of the all-hip fracture in elderly. The proximal femoral nail (PFN) is an intramedullary device used for the treatment of unstable sub-, intra-, per trochanteric femoral fractures. **Objective:** The aim of the study is to assess the functional outcomes of proximal femoral nailing for unstable intertrochanteric femoral fracture in-patient more than sixty years old. **Patients and Method:** The study is prospective interventional in Al-Mosul teaching hospital. A total seventy patients above sixty years with isolated closed unstable intertrochanteric fracture of femur depended on Evans classification were treated by PFN during the period from the January 2021 till the July 2022 with follow-up for functional outcome measured at three and six months using Harris Hip Score. **Results:** Of the seventy patients 44 (62.85%) females, 26 (37.15%) males. Forty-six of the patients had right side and twenty-four left side. Most of the patients sustained injury after fall from standing height, which are sixty (85%) patients, while only ten (15%) patients RTA. Most of the patients were between 71-80 years (51%). Mean operative time 90 minutes. Two patients developed superficial infection at the site of operation, two patients had lateral migration of the neck screw, eight patients had varus collapse of the fracture site and six patients had abductor weakness. On follow up, we lost the follow up of two patients. The functional outcome at the end of 6 months was poor for two (2.9%) patient, fair for six (8.8%) and good for 20 (29.4 %) patients and excellent for 40 (58.8%) patients. Mean HHS at the end of 6 month was 88. **Conclusion:** For unstable intertrochanteric fractures, the PFN has significantly giving the best outcomes in early restoration of the walking ability and needs short operative time as well as smaller incision. PFN gives stable fixation and early post-operative mobilization and good fracture healing.

KEYWORDS: Harris Hip Screw, Intertrochanteric fracture, Proximal Femoral Nailing.

INTRODUCTION

Intertrochanteric fractures involve the proximal end of the femur passing through and between both trochanters, with or without extension into the upper femoral shaft. It is widely known that the incidence of intertrochanteric fractures increases with aging.^[1] A fall from a standing position is the main cause of intertrochanteric fractures in the older population. Other comorbidities are common in people with osteoporosis, which increases the risk of falling. The type of fall that causes a hip fracture is also more common in the elderly than in the general population. A slower walk results in less forward motion. Numerous factors, including decreased osteoblastic

biosynthetic and replicative capacity, increased osteoclast activity, decreased physical activity (a stimulus for bone remodeling), genetic predisposition, decreased calcium intake, and hormonal influences, lead to the loss of bone mass in the elderly. Overall, this causes bone resorption to exceed bone growth.^[2] Because of estrogen deficiencies, postmenopausal women are particularly at risk. In the 30 to 40 years following menopause, women can lose up to 35% of their cortical bone and 50% of their trabecular bone.^[2] Numerous classification systems developed over the past six decades Figure (1), but none have been found to be universally accepted internationally.^[3,4]

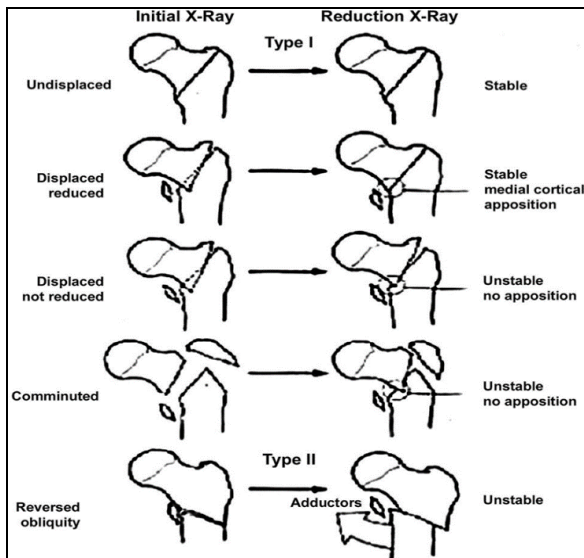


Fig. (1): Evans Classification.^[4]

Around 5% of fractures are highly unstable, with the fracture direction parallel to the femoral neck. If the fracture was treated with a sliding hip screw and a side plate, there is a high failure rate. Because of the angle of the fracture, there is no bone to prevent the screw from slipping laterally. In the past, these fractures received little attention since they occurred through the cancellous bone, which has a good blood supply, and because they healed on their own without any active therapy. However, conservative management resulted usually in malunion with varus and external rotation deformity and a short limb gait. While surgically can be implanted more quickly, with less blood loss and they allow for early weight bearing accompanied by less subsequent shortening on long-term monitoring.⁽⁵⁾ Due to comorbidities linked to significant morbidity and mortality, elderly individuals frequently have a poor prognosis and undergo declines in their general health after surgery. In fact, the majority of patients who survive have decreased mobility, and about 30% of these patients pass away within a year of their surgeries. Therefore, effective treatment by proximal femoral nailing of unstable IT fractures in elderly patients may lead to faster healing, early functional recovery, a lower mortality rate, and a decreased rate of reoperation.^[6,7] Treatment failure using internal fixation devices for unstable IT fractures, on the other hand, has been found to reach up to 50%. Furthermore, in elderly, osteoporosis, comminution, and instability frequently preclude early resumption of full weight bearing after the internal fixation of unstable IT fractures.^[8] Because of the biomechanical advantages of IMN and the added fixation stability provided by the helical blade shape, proximal femoral nail antirotation (PFNA) is one of the most preferred surgical treatments. When compared to other devices, these variables improve postoperative outcomes with PFNA by having a very low fixation failure rate,

reduced perioperative blood loss, and a shorter length of hospital stay.^[9,10]

PATIENTS AND METHOD

The study is prospective interventional study carried out in orthopedic unit in Mosul teaching hospital from January 2021 to July 2022 in Mosul city. Seventy patients with unstable intertrochanteric fracture of both sexes, 44 patients were female and 26 were male above 60 years old presented to the casualty unit. After sustaining a fall on the ground resulting in isolated unilateral unstable intertrochanteric fracture diagnosed by clinical examination and conventional plain X-ray of the hip joint. Depending on Evan classification (unstable) and Reverse obliquity fractures were included in this study. Patients below 60 years with compound stable or unstable and closed stable intertrochanteric femoral fracture were excluded from the study. All patients were evaluated preoperatively, which included detailed history, the radiograph of pelvis with both hips done. Applying Skin traction to all cases, medical consultation done for most of the patients, analgesia given. The patients sent for full investigation including chest X ray, ECG, laboratory tests (CBC, virology screen like HIV, HBC, HCV and COVID 19, blood sugar, renal function tests), and blood prepared for most of them. Prophylactic antibiotics injection used with fourth generation cephalosporin one hour before anesthesia. For patient who allergic to cephalosporin they received aminoglycoside gentamicin injection 6mg /kg/day. A verbal and written consent was obtained from each patient before participation in the study. The average time between the trauma and the operations was about 24-72 hours. The patient present with an externally rotated and short lower extremity Figure (2). When the patient is fit for surgery, operation performed using proximal femoral nailing system.



Fig. (2): externally rotated and short lower extremity.

In the operative theater preparation of C-arm and orthopedic table. Spinal anesthesia given to the patients. Put the patient on orthopedic table, close reduction done and confirmed by AP and lateral view by C- arm. The unaffected side put in abduction and the fractured side in adduction with internal rotation Figure(3). Preparation of proximal femoral nailing system done by surgeon assistant Figure (4).



Fig. (3): C-arm A.P view and lateral view.



Fig. (4): proximal femoral nailing system.

The affected Limb was scrub with povidon iodine and draped under sterile condition and longitudinal incision

about 3-5 cm over the greater trochanter with incisional length about 3-4 cm Figure (5).



Fig. (5): (A) scrubbing and draping (B) longitudinal incision.

The entry point identified by the C-arm, which is just medial to the tip of the greater trochanter, Awl is use to

create the entry point and guide wire was inserted down to the shaft Figure (6).



Fig. (6): entry point and guide wire insertion.

Proximal femoral nail inserted, the size of the nail was determined according to the width of the femoral canal. Proximal screw inserted and confirmed by AP and lateral

view by C-arm after determining tip-apex distance and femoral neck shaft angle. Distal screw inserted and confirmed by C- arm Figure (7).



Fig. (7): Nail, proximal and distal screw insertion.

Then the cup screw was positioned Figure (8).

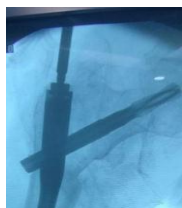


Fig. (8): Cup screw positioned.

The patient admitted to the orthopedic ward to ensure good monitoring for them, cefepim started about one

hour from the skin incision and continued for 3-5 days then changed to oral antibiotics (400 mg, cefexim capsule) for another 5 days. Subcutaneous enoxiparin (4000 I.U) given to all patients 6 hours after the operation and continued for two weeks. Active hip and knee exercise started in the first postoperative day with manual compression of the calf and elastic stockings. Patients were encouraged ankle and calf exercises from day one and mobilized weight bearing from the second postoperative day depending upon the physical condition of the patient. Postoperative radiograph performed Figure (9), the wounds checked on the 3rd and 6th postoperative day. The patients discharged within three days

after the operation, out patients' evaluation done at the sixth day, Stitches removed after 2 weeks from the surgery and another evaluation done every three weeks. As soon as the general condition permitted, a non-weight bearing position performed. Depending on the stability of the fracture and the effectiveness of the fixation, weight bearing started or delayed for patients with unstable or ineffective fixation. All patients monitored at monthly intervals for six months, check X-rays taken to evaluate fracture union and fixation failure. All patients had radiographic evaluation for fracture alignment, implant-related problems, progress and time to union, and other factors. Harris hip score used to assess the impact of hip fractures on the patient's quality of life, this method applied considering the return of patient or not to all the activities that used to perform before the accident.



Fig. (9): Pre-operative and post-operative A-P radiograph.

Table (2): Age Distribution.

Age group (in years)	Frequency	Mean of ages	Percentage
60-70	12	64.5	17.1
71-80	36	74.9	51.4
Above 80	22	81.45	31.4
Total	70	73.64	100.0

The fracture was distributed as 46 (65.7%) of the patients had right sided fracture while only 24 (34.3%) of the patients had left sided fracture (Table 3).

Table (3): Side of injury.

Side of injury	Number of patients	Percentage
Right Side	46	65.7%
Left Side	24	34.3%
Total	70	100%

Regarding mechanism of injury, the results showed that 60 (85.7%) of the patients subjected to fall, while 10 (14.3%) of patients were subjected to RTA (Table 4). Trivial fall mostly seen in elderly post-menopausal women who are affected by osteoporosis that weakens the bone matrix leading low velocity injury

Table (4): Mode of Injury.

Mode of injury	Frequency	Percentage
Fall down	60	85.7
RTA	10	14.3

RESULTS

The study included seventy patients suffering from unstable intertrochanteric fracture of femur and treated with PFN, 44 (62.85%) patients were females and 26 (37.15%) were males with female to male ratio of 1.69 (Table 1).

Table (1): Sex Distribution.

Sex	Frequency	Percentage
Female	44	62.85
Male	26	37.15
Total	70	100.0

The age distribution of the study was above 60 years old, the largest number of patients was between 71-80 years, where 36 patients had fracture in compare with the lowest number that was 12 patients between 60-70 years (Table 2).

All the patients were graded one walking ability before the injury and according to Koval grade of seven (Table 5).⁽¹¹⁾

Table (5): Grades of Walking Ability.

Grade	Pre-injury walking ability
Grade 1	Independent community ambulatory
Grade 2	Community ambulatory with cane
Grade 3	Community ambulatory with walker
Grade 4	Independent house hold ambulatory
Grade 5	House hold ambulatory with cane
Grade 6	House hold ambulatory with walker
Grade 7	Nonfunctional ambulatory

The results of study revealed that the mean operative time was (90 minutes). More than one complication occurred in the same patient was seen. Two cases with superficial infection at the site of incision treated with dressing and antibiotics, two patients had lateral migration of neck screw. On follow up, eight patients had varus collapse of fracture but it did not complain on routine day-to-day activity, six patients had abductor weakness which corrected by physiotherapy. Weight bearing divided into Partial weight bearing & Full weight bearing (Table 6). In the PFN, group 80% of patients

allowed partial weight bearing within 3 weeks of surgery, while 20% of patients after 3 weeks of surgery.

Table (6): Partial Weight Bearing.

Duration in Weeks	Number of Patients
Within 1 st week	20 (29.41%)
1-3	35 (51.47%)
4-6	11 (16.17%)
7-10	2 (2.94%)
Total	68 (100%)

Patients with proximal comminution, lateral wall deficient, severe osteoporosis partial weight bearing delayed. While (85.3%) patient allowed full weight bearing within 12 weeks after surgery and (14.7 %) patient allowed full weight bearing after 12 week (Table 7).

Table (7): Full Weight Bearing.

Duration in weeks	No. of the Patients
6-8	39 (57.53%)
8-12	19 (27.94%)
>12	10 (14.7%)
Total	68 (100%)

Most of patients are with equal limb length. Thirteen patients have <1cm limb shortening, the average shortening was (5.80) mm (Table 8).

Table (8): Limb Length Discrepancy.

	<1cm Shortening	Normal
No. of patients	13	55
Percent	19.10%	80.88%

The fracture line was visible in X-rays in 13 (19.12%) patients, while 55 (80.88%) patients showed radiological union at six months (Table 9).

Table (9): Radiological Fracture Line.

Fracture line	Number of patients
Visible	13 (19.12%)
Not visible	55 (80.88%)
Total	68 (100%)

At the end of the study, we lost the follow up of two patients so our result will based on 68 patients. At the end of 3-month HHS was poor for 8 patients 11.8%, fair for 2 patient 2.9%, good for 50 patient 73.5% and excellent for 8 patient 11.8%. Mean HHS at the end of 3 month was 80.134 (Table 10).

Table (10): Functional outcome at end of 3 months.

Functional outcome	Frequency	Percentage
Poor	8	11.8
Fair	2	2.9
Good	50	73.5
Excellent	8	11.8
Total	68	100.0

Functional outcome at the end of 6 months was poor for 2 patient (2.9%), fair for 6 patients (8.8%) and good for 20 patients (29.4 %), excellent for 40 patients (58.8%). Mean HHS at the end of 6 month was 88 (Table 11).The average duration of hospital stay was 3 days. All patients followed up at 3 and 6 months respectively.

Table 11: Functional outcome at end of 6 months.

Functional outcome	Frequency	Percentage
Poor	2	2.9
Fair	6	8.8
Good	20	29.4
Excellent	40	58.8
Total	68	100.0

DISCUSSION

Various implants used in treatment of intertrochanteric fracture of the femur, and restoring the stability with early fixation and mobilization, which is very important in decreasing morbidity and mortality rate. According to Ankit J. et al.^[12] the fractures generally seen more in female, which are like our study that the female percentage was 62.85%. That supports the opinion that the bone stock has an important part in the action of fractures in the elderly patients that mostly happened after the fall. Wei Ting Lee et al.^[13] study show young aged, patients were commonly predisposed to high-energy trauma like motor vehicular accidents, crush injuries, falls from a height, and others. Whereas older patients were generally involved in low-energy trauma like falls during walking, which is nearly like our study that showed most of the patients were have their fractures because of the trivial fall. In our study, the largest number of patients was between 71-80 years age, which were close to the age distribution of Gadegone WM et al.^[14] that was between 58–81 years and the sex distribution was female (51.21%) and male (48.78%) patients, which was also like our study in which (62.8%) female and (37.1%) male. C-E. Hsu et al.^[15] study show patients with intertrochanteric fractures the right side were affected in (46.6%) patients and the left side in (53.36%), while our study found that (65.7%)of the patients had right sided fracture and only (34.3%) of the patients had left sided fracture. In our study, 60 patients (85.7%) had history of trivial fall and in spite that our patients were old people, 10 patients (14.3%) had RTA, whereas another study directed by Wei Ting Lee et al.^[13] presented young patients were commonly predisposed to high-energy trauma like motor vehicular accidents, crush injuries. In our study the duration of operation was 90

minutes, while according to Lee *et al.*^[13] the average duration of PFN surgery was 90.6 minutes. Bartonicek J *et al.*^[16] said that the average duration of surgery ranges depending on the applied implants, type of fracture and the skill of the surgeon, which mostly between 30-60 minute duration. PFN surgery has duration of 91 minute as Jonnes C. *et al.* said.^[17] Bhakat U, Bandyopadhyay R,^[18] found that the average duration of surgery for the PFN (Avg. time 48.73min). In addition, Bhakat U, Bandyopadhyay R,^[18] study found that there were no cases of infection after PFN surgery and that unlike our study that found that two cases of superficial infection. F.James *et al.*^[19] documented that Intertrochanteric hip fractures surgery have significant complications rates including a 5% nonunion rate, a 5% infection rate, and in our study we documented 2.85% of superficial infection. Gadegone WM. *et al.*^[14] found patients developed lateral migration of neck screws which comparing to our study that found (2.9%) of patients has lateral migration of the neck screw. In addition, patients had 6–7 mm of shortening which comparing to our study (19.1%) patients had shortening less than one cm.^[14] Sharath Kumar *et al.*^[20] concluded that abductor weakness was quite common in patients treated with PFN. This complaint was often overlook like our study, while we found only (8.8%) patients that had abductor muscle weakness postoperatively which is consider uncommon. Gadegone WM. *et al.*^[14] found no limb length discrepancy in any of cases with anatomical reduction that is unlike our study when we found limb length discrepancy in 17 patients. Bhakat U, Bandyopadhyay R,^[18] observed that the average shortening in the P.F.N was 5.35 mm and that support our study when we found shortening in 13 patient and all of them were less than 1 cm. Ankit Jose.*et al.*^[12] said that PFN gives stable fixation and rapid post-operative mobilization and fracture union mostly in the complex proximal femoral fractures that include comminuted, unstable, reverse oblique fractures and fractures of osteoporotic bones. PFN showed excellent results in his study. Which is the same outcome as we found. Faisal M, Nistane P.^[21] found that PFN have good functional outcome with unstable fractures, PFN requires lesser operation time and lower soft tissue dissection, PFN is giving better fixation device for most unstable intertrochanteric fractures. The functional outcome of our study was depended on Harris Hip Score, from the 70 patients two patients were lost to follow up. At the end of 3-month following up, the HHS was poor for eight patients (11.8%), it was fair for two patient (2.9%), also good for fifty patient (73.5%) and excellent for eight patients (11.8%). The mean HHS at the end of three month was (80.134), which is considered good according to our study. The functional outcome after six months was poor for two patient (2.9%), it was fair for six patients (8.8%), and good for twenty patients (29.4 %), excellent for forty patients (58.8%).The mean HHS at the end of six months was (88) , which was consider to be good according to our study. In a study by Uzen *et al.*^[22] which included 35 patients, the mean HHS was 82.1 at

the end of 4 months. The result was excellent in 11 patients 31.4%, good in 15 patients 42.9%, fair in seven patients 20%, and poor in two patients 5.7%. In addition, Faisal M and Nistane P.^[21] found that the usage of PFN was the best fixation of the unstable intertrochanteric fractures. We found that there was a good functional outcome after the PFN intervention in fixing unstable intertrochanteric fracture. Myderrizi N.^[1] also supported our results by finding that PFN is good choice in treating intertrochanteric fractures. According to Cyril Jonnes, *et al.*^[23] PFN is good in type two intertrochanteric fractures due to decreased blood loss, decreased duration of surgery, fast weight bearing and mobilization, decrease hospital stay, reduced risk of infection and complications. Min Wk *et al.*^[11] said that PFN given good outcomes biomechanically and fewer complications for the treatment of reverse obliquity intertrochanteric fractures. Christian Boldin *et al.*^[24] considered that PFN was good minimum invasive implant for the unstable proximal femoral fractures when closed reduction is possible. The modification of the PFN and careful surgical technique should decrease the high rate of complications. Faisal M and Nistane P.^[21] found that PFN provides more biomechanically stable construct by decreasing the distance between hip joint and implant.

Limitations of Our Study: Our study lack of a control or comparator groups, so it is hard to make a definitive conclusion whether this implant was the best treatment option for all intertrochanteric fractures of femur. Our sample size considered small, larger sample size might give a better assessment of this surgical intervention. Our study was time limited, the patients followed up first for three months and then for six months. Therefore, the long-time effects of this intervention stay unknown. A longer follow up might have given a complete assessment of this intervention.

CONCLUSION

For unstable intertrochanteric fractures, the PFN has significantly giving the best outcomes in early restoration of the walking ability and needs short operative time as well as smaller incision. PFN gives stable fixation and early post-operative mobilization and good fracture healing.

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