



Outcome of treatment of Unstable Intertrochanteric Fracture by Proximal Femoral Nail (PFN)

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Abstract

Background: Proximal Femoral Nail (PFN) is a surgical technique used to treat unstable intertrochanteric fractures, which are fractures that occur in the upper portion of the thigh bone (femur). The procedure involves using a nail-like device that is inserted into the femur and secured in place with screws to stabilize the fracture and promote healing. It is a commonly used treatment option for this type of fracture and can lead to good outcomes in most cases. The aim of the study was to observe the outcome of Unstable Intertrochanteric fracture by Proximal Femoral Nail (PFN). **Material & Methods:** This prospective observational study was conducted at the Department of Orthopedics, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh. The study duration was 2 years, from July 2017 to June 2019. A total of 34 cases were included in the study using purposive sampling (non-randomized) according to availability of the patients and considering inclusion and exclusion criteria. **Results:** The participants' age range was 16-90, with a mean of 56.91 ± 17.76 . Most (35.29%) were 61-75 years old. 61.76% were female and 38.24% were male. 50% were housewives, 14.71% ex-service holders, 14.71% service holders, 11.76% businessmen, 5.88% students, and 2.94% farmers. The leading cause of injury was falls on slippery ground (55.88%), followed by motor vehicle injuries (44.12%). 70.59% of injuries occurred on the right side and 29.41% on the left. 76% had Kyle Type III fractures, 24% had type IV. 85.29% had open reduction, 14.71% had closed reduction. The mean duration of injury to operation was 15.59 days and the mean hospital stay was 19.15 days. 70.59% had no complications and 55.88% reported no pain at last follow-up. 58.82% had a good Harris hip score and 58.82% had excellent outcomes by final follow-up. **Conclusion:** The majority of patients in this study were in the 61-75 age range and female, with the most common cause of injury being falls on slippery ground. The most common fracture type was Kyle type IV, with a major portion of cases requiring open reduction. The rate of complications was relatively low, and the functional outcomes were acceptable and comparable to other studies. The duration of injury to operation and hospital stay were slightly longer than other studies, likely due to the busy nature of the study location. Overall, the Proximal Femoral Nail is a safe and effective treatment option for unstable proximal femoral fractures.

Keywords:- Intertrochanteric, Fracture, Proximal, Femoral.

INTRODUCTION

Intertrochanteric fractures are common among the geriatric population and are caused by a fall or high-energy trauma.^[1] The goal of treatment is to restore function with a low rate of surgical and medical complications. One common treatment option is the use of a Proximal Femoral Nail (PFN), a surgical method that provides stability and support to the affected bone while it heals. Studies have shown that the use of PFN has a high union rate and successful healing of fractures.^[2,3] Additionally, it is considered less invasive compared to traditional methods, such as open reduction and internal fixation (ORIF). The primary goal of treatment is early mobility to prevent complications associated with immobilization.^[4] To provide a rapid and safe bone healing process with good functional restoration, anatomical fracture reduction is the major objective for adequate fracture treatment in mostly elderly patients with intertrochanteric femur fractures.^[5] The best treatment option for unstable intertrochanteric fractures is still a matter of debate. Management includes both non-operative and operative techniques. Non-operative treatment is indicated in non-ambulatory patients and those at high risk of perioperative mortality.^[6] But it is associated with various complications such as pneumonia, urinary tract infection, decubitus ulcer, and DVT. Dynamic hip screws are the most commonly used extramedullary devices for the treatment of hip fractures,^[7] but sliding hip screw is not ideal for unstable intertrochanteric fractures.^[8,9] Intramedullary nails include Gamma nail, Smith & nephew nail, proximal femoral nail etc; they are indicated in both stable and unstable fractures and have a lower implant

failure rate and no dissection at the fracture site.^[10] The proximal femoral nail (PFN) is an intramedullary implant designed by the Arbeitsgemeinschaft für Osteosynthesefragen (AO) in 1997, that offers many advantages over other intramedullary devices.^[11] It has an anti-rotation screw, an undreamed implantation technique, and the possibility of a static or dynamic distal bolting device, which all make it a better option for unstable intertrochanteric fractures.^[2,3] In Bangladesh, the incidence of unstable intertrochanteric fractures has become more common with increasing life expectancy and motor vehicle injury. However, the steep learning curve and technically ambitious implantation of PFN still lead surgeons to choose extramedullary devices. PFN offers biomechanical modifications compared to existing systems, such as high rotational stability of the head and neck fragments and the possibility of static or dynamic distal locking.^[5] It functions as an internal splint that allows secondary fracture healing, provides angular stability with greater degree of adjustment compared with angled blade plate and offers the same variability while avoiding excessive bone removal. The PFN also has been shown to prevent the fractures of the femoral shaft by having a smaller distal shaft diameter which reduces the stress concentrations at the tip.^[10] The present study aimed to evaluate the outcome of fixation of unstable intertrochanteric fractures with PFN in a Bangladeshi demographic setting. The results of this study can provide valuable insights into the effectiveness of using PFN for the treatment of unstable intertrochanteric fractures in a Bangladeshi population.

MATERIAL AND METHODS

This prospective observational study was conducted at the Department of Orthopedics, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh. The study duration was 2 years, from July 2017 to June 2019. A total of 34 cases were included in the study using purposive sampling (non-randomized) according to availability of the patients and considering inclusion and exclusion criteria. The study evaluated the outcome of fixation of unstable intertrochanteric fractures of the femur using a pre-tested structured questionnaire containing history, clinical examination, laboratory investigations, pre-operative, perioperative, post-operative complications and post-operative follow up findings. Follow-up was conducted for at least 6 months for each participant. The data was processed and analyzed using Microsoft Excel 2010, with categorical data expressed as frequency and percentage, and quantitative data presented as mean and standard deviation. The study had institutional approval from the Institutional Review Board (IRB) at NITOR, and all patient data and information were collected with written consent. Participation was voluntary and confidentiality was assured and maintained.

Inclusion Criteria

- Patients >18 years of age
- Injury on either or both sides
- Only closed fractures
- Unstable intertrochanteric fracture of the femur of any pattern
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Open contaminated fractures
- Patient below 18 years of age
- Multiple fractures and poly-trauma
- Patient who cannot follow up at least for 6 months
- Pathological fracture.

RESULTS

The age range of the participants was between 16 and 90, with a mean age of 56.91 ± 17.76 , and a majority of participants (35.29%) being from the age group of 61-75 years. The majority of the participants (61.76%) were female, while 38.24% were male. In terms of occupation, 50% of the participants were housewives, 14.71% were ex-service holders, 14.71% were service holders, 11.76% were businessmen, 5.88% were students, and 2.94% were farmers. The leading cause of injury was falls on slippery ground (55.88%), followed by motor vehicle injuries (44.12%). The majority of the injuries occurred on the right side (70.59%), while 29.41% occurred on the left side. [Table 1]

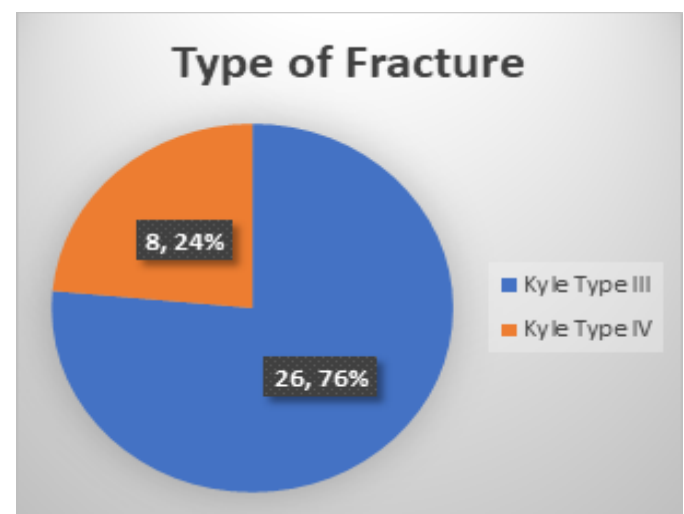


Figure 1: Distribution of participants by type of fracture

About 76% of the participants had Kyle Type III fractures, while 24% had type IV fractures.

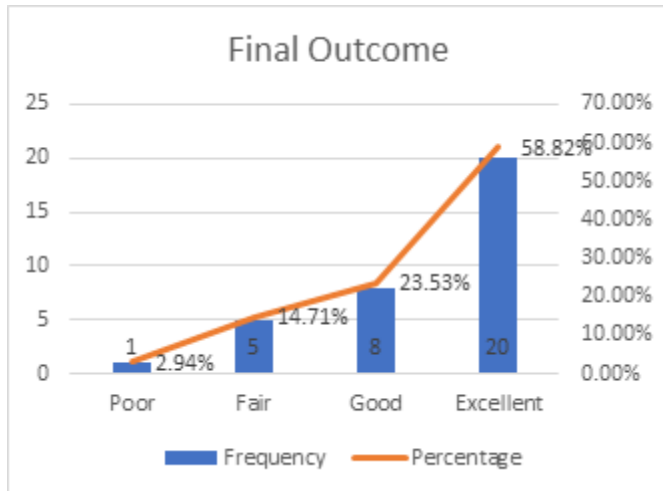


Figure 2: Distribution of participants by final outcome

Majority of the participants (58.82%) had excellent outcomes, and 23.53% had a good outcome. 14.71% had a fair outcome, while only 1 patient had a poor outcome by the final follow-up.

The majority of patients (85.29%) had their fractures reduced through an open method, while the remaining 14.71% had closed reductions. The mean duration of injury to operation was 15.59 days, with a standard deviation of 5.19 days. The patients stayed in the hospital for an average of 19.15 days, with a standard deviation of 5.19 days. The duration of hospital stay was distributed as follows: 8 patients (23.53%) stayed between 10-14 days, 10 patients (29.41%) stayed between 15-19 days, 8 patients (23.53%) stayed between 20-24 days, and 8 patients (23.53%) stayed between 25-29 days. [Table 2]

Table 1: Distribution of participants by baseline characteristics.

Baseline Characteristics	Frequency	Percentage
Age		
16-30	3	8.82%
31-45	8	23.53%
46-60	7	20.59%
61-75	12	35.29%
76-90	4	11.76%
Mean±SD		56.91±17.76
Gender		
Male	13	38.24%
Female	21	61.76%
Occupation		
Housewife	17	50.00%
Ex-Service Holder	5	14.71%
Service Holder	5	14.71%
Businessmen	4	11.76%
Student	2	5.88%
Farmer	1	2.94%
Cause of Injury		
Motor Vehicle Injury	15	44.12%



Fall on slippery ground	19	55.88%
Side of Injury		
Right	24	70.59%
Left	10	29.41%

Table 2: Distribution of participants by Fracture management related characteristics.

Baseline	Frequency	Percentage
Method of Reduction		
Open	29	85.29%
Closed	5	14.71%
Duration of Injury to operation in days		
6-10	7	20.59%
11-15	8	23.53%
16-20	10	29.41%
21-25	9	26.47%
Mean±SD		15.59±5.19
Duration of Hospital Stay in days		
10-14	8	23.53%
15-19	10	29.41%
20-24	8	23.53%
25-29	8	23.53%
Mean±SD		19.15±5.19

Table 3: Distribution of cases according to post-operative complications (N=34).

Complication	Frequency	Percentage
No complication	24	70.59%
Wound infection	6	17.65%
Pulmonary infection	4	11.76%
Bed sore	1	2.94%
DVT	1	2.94%

24 out of 34 patients (70.59%) did not have any complications during their treatment. 6 out of 34 patients (17.65%) experienced wound infection, 4 out of 34 patients (11.76%) experienced pulmonary infection, 1 out of 34 patients (2.94%) developed a bed sore, and 1 out of 34 patients (2.94%) developed DVT (deep vein thrombosis).

Table 4: Distribution of Patients according to pain status at final follow-up (N=34)

Pain at last follow up	Frequency	Percentage
No pain	19	55.88%
Slight pain	13	38.24%
Mild pain	1	2.94%
Moderate pain	1	2.94%

At the last follow-up, 19 participants (55.88%) reported no pain, 13 participants (38.24%) reported slight pain, 1 participant (2.94%) reported mild pain, and 1 participant (2.94%) reported moderate pain.

Table 5: Distribution of cases according to HHS at final follow-up (N=34).

Harris hip score	Frequency	Percentage
<60	1	2.94%
60-74	5	14.71%
75-89	8	23.53%
90-100	20	58.82%
Mean±SD	87.68±16.89	

The table shows that the majority of the participants (58.82%) had a score between 90 and 100, indicating good function. A small number of participants (14.71%) had a score between 60 and 74, indicating moderate function. Only 2.94% of the participants had a score below 60, indicating poor function. The mean Harris hip score for the participants was 87.68, with a standard deviation of 16.89.

DISCUSSION

The Proximal Femoral Nail (PFN) is a device used to treat unstable proximal femoral fractures. It is inserted through the greater trochanter and uses a single proximal interlocking screw for fixation and compression. The intramedullary position of the device is closer to the center of gravity and more reliable in resisting high forces across the medial calcar. In this study, the highest number of patients (35.29%) were in the 61-75 years age group, with a mean age of 56.91±17.76 years. The majority of patients were female (62%) and the most common cause of injury was fall on slippery ground (56%). This finding was somewhat different from other studies, where the mean age of participants were over 70 years.^[3,12] This decreased age of incidence of occurring intertrochanteric is mainly due to the increasing incidence of road traffic and motor vehicle accidents leading to younger patients having these type of fractures. The increased female prevalence in our study was mainly due

to females being more susceptible to osteoporotic fractures, leading to an overall increase in the incidence of fractures. This was similar to the findings of other studies as well.^[13,14] Like our study, motor vehicle accidents and fall from heights are the most common causes of injury observed in multiple other studies as well.^[3,14] The most occurred fracture was Kyle type IV (76%, n=26). The remaining 8 (24%) fractures were Kyle type III. According to the AO classification, these fractures coincide with 31-A2.3 and 31-A3 fractures. The type of fractures in the present study coincided with those of Yassari et al.^[14] Among the 34 cases, only 5 (15%) fractures can be reduced by closed method. In the rest 29 (85%) cases, the fracture site has to be opened for reduction. This was different from the findings of Boldin et al., who only had 9% open reductions.^[15] As the learning and practice of PFN technique improves, the rate of open reduction is estimated to reduce. The mean duration of injury to operation was 15.59±5.19

days, ranging from 6 days to 25 days. This delay was significantly higher compared to other studies with an average of 3-5 days of delay.^[14] However, as the study place is an extremely busy tertiary center, this delay is unfortunate but understandable. The mean duration of hospital stay was 19.15 ± 5.19 days, ranging from 10 days to 29 days. Most of the cases stayed in the hospital between 15 to 19 days (29.41%, n=10). No complication occurred in 24 (70.59%) cases. Wound infection was the most common complication, found in 6 (17.65%) cases. Four patients had pulmonary infection, 1 (2.94%) had bed sore, and 1 (2.94%) had DVT. There was no technical complication like wrong screw length in the present study. The incidence of complications in our study was similar to the findings of other comparable studies.^[3,14] In this present series, a total of 6 (17.64%) cases had systemic complications. There was no instance of femur shaft fracture. At the last follow-up after operation, 19 (55.88%) cases had no pain, 13 (38.24%) cases complained of slight pain. Among the rest 2 cases, 1 (2.94%) had mild pain and 1 (2.94%) had moderate pain at the last follow-up. This was relatively better compared to a few other studies that reported cases of severe pain.^[3,14] The functional statuses of the cases were measured according to Harris hip score.^[16] The mean HHS at the last follow-up was 87.68 ± 16.89 , ranging from 33 to 100. Of the 34 cases, 20 (58.82%) had a HHS between 90 to 100, 8 (23.53%) had a HHS between 75 to 89, 5

(14.71%) had a HHS between 60 to 74, and the remaining 1 (2.94%) had a HHS less than 60. This distribution of HHS was similar to the findings of comparable studies.^[17,18] After the last follow-up, the final outcome was assessed using the HHS tool. Of the 34 cases, 20 (59%) were excellent, 8 (23%) were good, 5 (15%) were fair, and the remaining 1 (3%) was poor. The functional results were acceptable and comparable with the results of other studies.^[3,19]

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSIONS

The majority of patients in this study were in the 61-75 age range and female, with the most common cause of injury being falls on slippery ground. The most common fracture type was Kyle type IV, with a major portion of cases requiring open reduction. The rate of complications was relatively low, and the functional outcomes were acceptable and comparable to other studies. The duration of injury to operation and hospital stay were slightly longer than other studies, likely due to the busy nature of the study location. Overall, the Proximal Femoral Nail is a safe and effective treatment option for unstable proximal femoral fractures.

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