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A Comparative Study of Intertrochanteric Fracture Fixation with Hip Fracture Nail and Proximal Femoral Nail Antirotation II In Elderly Indian Patients.

[1]Dr. Samson Samuel E, [2]Dr. Vishak K. G, [3]Dr. Anu Elsa Joseph

Corresponding Author: Dr. Vishak K. G

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Abstract

Introduction: Geriatric Hip Fractures are one of the most commonly seen fractures worldwide and was once considered to be terminal. Over the years the Intramedullary Fixation Devices for unstable fractures has evolved over time. This study aims to determine which of the two main devices are superior and more beneficial with regard to patient care. The devices compared are the Hip Fracture Nail and the Proximal Femoral Nail Antirotation II (PFNA II).

Methods: This study was conducted at a Tertiary Care Center in Kerala from 2019 February to 2020 August with a total sample size of 60 cases, half of which underwent fixation with Hip Fracture Nail and the other with PFNA II. On obtaining an informed consent from the patients, their respective demographics, fixation devices, operative data and follow-up data (clinical and radiological till 6 months) were studied. Comparison of the functional outcomes were done using the Modified Harris Hip Score, VAS score and X- rays.

Results: This study included 60 patients diagnosed with Intertrochanteric Fracture who underwent surgical intervention after being clinically and radiologically evaluated. Post discharge the patients were followed up regularly in 6th week, 12th week, and 24th week

Conclusion: The Hip Fracture Nail and the PFNA II both show equally good functional outcomes. The rate of complications is slightly lower with the HFN than with the PFNAII. Compaction of the cancellous bone with a telescoping screw in osteoporotic patients gives the HFN a slightly superior edge. Overall, there is a deficiency of studies comparing the two, research should be encouraged to rectify it.

Keywords: Original Research, Geriatric age group, Hip Fracture, Comparative Study, Hip Fracture Nail, PFNA II, Intertrochanteric Fractures, Modified Harris Hip Score, VAS, Boyd and Griffin's classification.

Introduction

The geriatric age group is a huge part of our society they also play a vital role in our personal lives. Any insult to their health has a combined effect on not only the patient

in question, but also on their families or caretakers. Hip Fractures in the elderly are one of the most commonly seen in our present time. While the causative factors are innumerable, the net effects are many. The continuous increase in the average life span coupled with a more sedentary lifestyle has lead to a greater number of these fractures. Within the population a greater increase of hip fracture has been observed to be in women as osteoporosis plays a part [1]. A few decades ago, these fractures were believed to have been terminal. Drastic complications brought on from long term immobilization a few of which are decubitus ulcers, aspiration pneumonia, pulmonary embolism have played a role in influencing this belief. To say that they have a huge impact on the healthcare system and society would be an understatement. As time has passed so have the methods of treatment for such fractures have evolved along with it. These methods are not just aimed to fix the fracture but also to obtain the optimal benefit for the patient with regard to their lifestyle. Intertrochanteric fractures are classified into two types either Stable or Unstable. The type of fixation depends upon this classification. Characteristics of the unstable type include posteromedial fragmentation, Basi cervical pattern, reverse obliquity patterns, displaced greater trochanteric (lateral wall) fractures and failure to reduce the fracture prior to internal fixation. [2]

The treatment for extracapsular fractures is mainly based on osteosynthesis with intramedullary (cephalon medullary) or with extra medullary (plate and sliding screw) implant. The dynamic hip screw which was considered to be the gold standard for treatment of stable fractures was found to be inappropriate to treat the unstable type of intertrochanteric fracture[3]. Despite its long-term popularity and success rate, the dynamic hip screw has limitations namely implant failure, varus deformity, high chance of infection and malunion. The use of an intramedullary nail coupled with a dynamic femoral head or neck femoral stabilization implant is the ideal method for fixation of unstable fractures [4]. The first intramedullary hip fracture fixation device allowing full weight bearing was the Standard Gamma Nail. The second-generation nail, the Trochanteric Gamma Nail was launched which was improved by shortening the nail by 2cm and reducing the medial-lateral bend from 10 degree to 4 degree. The third generation Gamma 3 Nail was introduced. It combines the principle of the compression hip screw (telescoping screw barrel) with the biomedical advantages of an intramedullary nail. The major development is the unique design and thread spacing of the lag screw which provides better resistance to cutout[5]. In 1996 AO/ASIF developed the proximal femoral nail as an intramedullary device for the treatment of unstable intertrochanteric and subtrochanteric fractures. On comparing with sliding hip screws, the proximal femoral nail is biologically more stable, has got rotational stability, load sharing property and is applied by closed fixation. Although proximal femoral nail is proven to be superior to extramedullary devices while treating unstable intertrochanteric fractures; screw cut-out, back out, varus collapse continues to be significant postoperative complications[6].

The proximal femoral nail Antirotation (PFNA) system was put into clinical use, as the devices were considered better for rotation and angular stability due to the single screw design ultimately leading to a better functional outcome with fewer draw backs. The PFNA-II was designed to tackle the drawbacks of PFNA, which was designed to have a Medio-lateral angle of 5° and a proximal diameter of 16.5 mm. The modified nail was

considerably better fit anatomically. This decreases the hoop stress inside the femoral shaft which in turn leads to a significant decrease in intraoperative and postoperative diaphyseal fractures. Alas, overall complications like helical screw back out, lateral soft tissue impingement, and varus collapse still remained a major drawback. In 2011, Schwarzkopf ran et al compared helical blade versus telescoping lag screw for intertrochanteric fracture fixation. He concluded that fracture compression using a solid single-diameter helical blade lag screw occurs at the expense of lateral protrusion of the screw into iliotibial band and surrounding soft tissue. Fracture compression using a dual-diameter telescoping lag screw which uses a combination of sliding and telescoping results in far less screw protrusion into the lateral soft tissue[7]

In 2014, Hip fracture nail with few changes from previous generation was introduced which was able to rectify the problems of previous generation nails. Lag screw was designed for high load absorption and easy insertion. Asymmetrical groove depth profile of the lag screw allows it to slide in the lateral direction only. Self-retaining set screw protects the lag screw against rotation and simultaneously allows sliding of the lag screw laterally. Self-retaining set screw can be inserted and locked through the loading bolt without removing the insertion handle. New design consists of an end cap which prevents bony ingrowth and adjusts the proximal nail length. It is said to be biomechanically superior to PFNA II.

Materials and Methods

This study was aimed to discern whether intertrochanteric fracture fixation with HFN has a better clinical and radiological outcome when compared to PFNA-II done at a tertiary care hospital. It was conducted as a longitudinal study post approval by the Ethics Review Board of Pushpagiri Medical College Hospital. The duration lasted from February 2019 to August 2020 comprised of a total of 60 randomly selected patients. All patients were informed in detail and written consents in the native language of the patients were obtained. A standardized structured questionnaire was provided before the surgery. Demographic information was collected along with any comorbidities, regular medications along with imaging done at the time of admission. Half of the patients underwent fixation with Hip Fracture Nail and the other half with PFNA I depending on the surgeon and patient's choice not based on the type of fracture. The inclusion criteria were limited to age (above 60 years) and patient fit for surgery. The exclusion criteria comprised of they were pathological, multiple or open in nature.

Intra operative findings such as fracture pattern, operating time, fluoroscopy exposure were recorded. Visual analogue score will be assessed at the time of admission, immediate post-operative period and during the first post- operative visit (after 1 week post discharge). Postoperative Harris Hip Score will be assessed immediate postoperative, then again at 6, 12, and 24weeks.

Figure 1: Preoperative and Postoperative X-ray with HFN

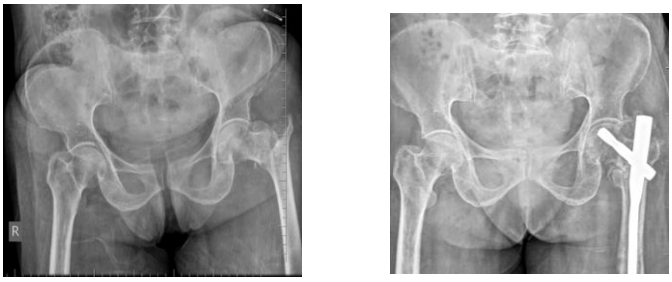


Figure 2: Preoperative and Postoperative X-ray with PFNA II

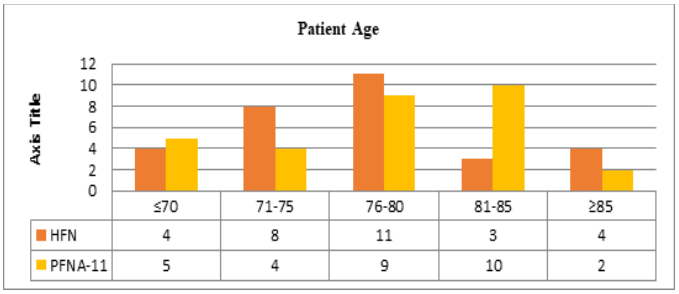
Results

Our study had a total of 60 patients who were then divided into two based on the implant used, that is the Hip Fracture Nail and PFNA II respectively. The study showed the mean age of patients in both groups was 77.9 ± 6.18 years (HFN) and 78.13 ± 6.5 years (PFNA II) showing not much of a difference(p=0.903). According to the Boyd and Griffin classification we found in the group operated with HFN;9.2% were Type II,42% were Type III, and 39.2% were Type IV. Similarly in the group operated with PFNA II;18% were Type I, 39.5% were found to be Type II in nature, 27.3%Type III, and 6% to Type IV. Average operative time with HFN was significantly lower averaging 45.6 ± 2.2 minutes whereas that of PFNA II was 51.1 ± 5.7 minutes with a significant p value (p value = 0.0001). Weight bearing was initiated at 12.57 weeks for those having HFN whereas those who underwent fixation with PFNA II was 12.07 weeks. The VAS score noted at immediate postoperative period was statistically significant with p=0.003, whereas the scores noted at admission and one week post operatively showed not much of a significance.

All the patients were given similar analgesics with few exceptions based on comorbidities. We observed that the Harris Hip Score during the immediate post-operative period was less than 70 in both groups. At the end of 12 weeks the average was 74.8 ± 2.7 for HFN and 63.07 ±1 2.2 for PFNA II with a significant P value of 0.0001. After 24 weeks, 10.3 % of HFN and 23.3% of PFNA II had score between 71-79,60.1% of HFN and 60.3% of PFNA II scored between 80-89, finally 13% of HFN and 18.3 % of PFNA II scored between 90-99 which is good result. The limitation of our study was the short duration. The functional outcome after 24 weeks was almost equal for both HFN and PFNA II, which indicates that both devices are good in Intertrochanteric fracture fixation. The latest design of HFN slightly superior over the PFNA II with regards to its biomechanical properties. In the HFN group four patients developed surgical site infection of which one patient eventually passed, four patients developed anterior thigh pain, one developed pneumonia, one patient developed DVT and eventually expired. Of the remaining, 3 patients contracted a superficial infection which resolved with appropriate antibiotic.

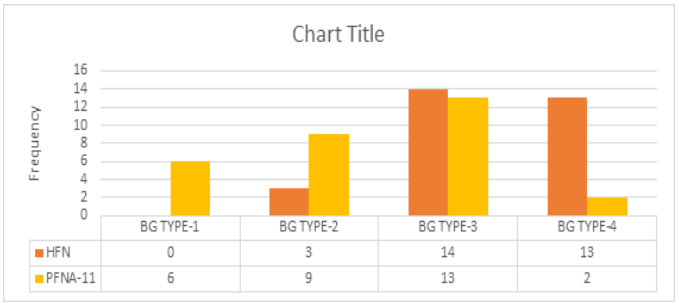
One of the patients who underwent fixation with HFN presented with mechanical failure, his functional outcome was poor. Within the group that underwent fixation with PFNA II, 4 patients reported anterior thigh pain, 2 patients developed pneumonia and eventually expired during the study period. Two patients reported proximal migration of the helical blade screw, of which one patient developed sores passed in the end. The second patient was determined to have a fair functional outcome. Within this group there were two reports of implant breakage, for which exchange nailing was done. Out of the 60 patients who were studies 5 patients from each group expired within 6 months of the post-operative period, the causes were found to be unrelated to the surgery.

Table 1: Distribution of the patients sample according to age.



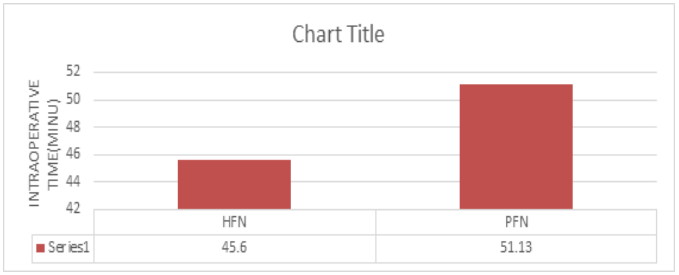
	≤70	71-75	76-80	81-85	≥85
HFN	4	8	11	3	4
PFNA-11	5	4	9	10	2

Table 2: Comparison of fracture type based on classification.



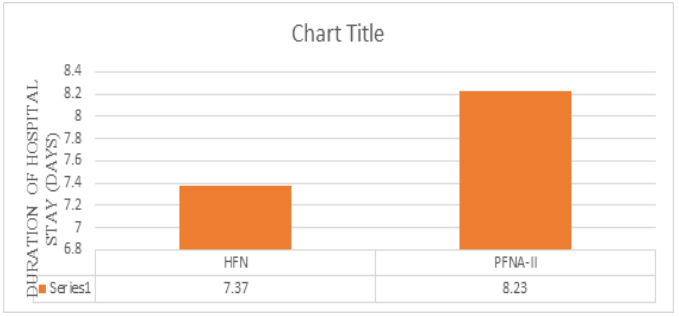
	BG TYPE-1	BG TYPE-2	BG TYPE-3	BG TYPE-4
HFN	0	3	14	13
PFNA-11	6	9	13	2

Table 3: Comparison of procedure based on intraoperative time.



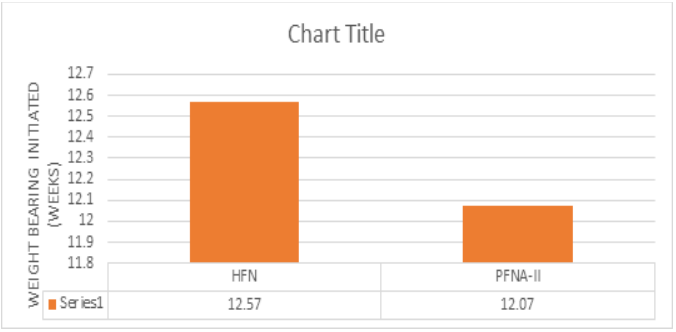
	HFN	PFN
Series1	45.6	51.13

Table 4: Comparison of duration of hospital stay based on procedure.



	HFN	PFNA-II
Series1	7.37	8.23

Table 5: Comparison of fracture union based on procedure.

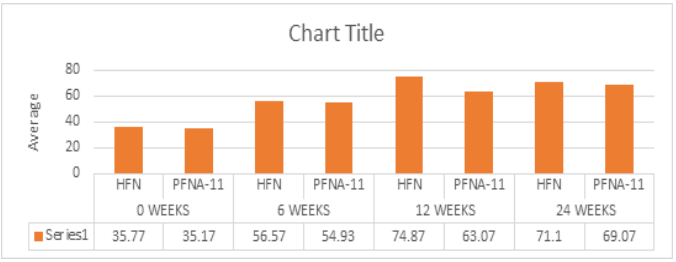


	HFN	PFNA-II
Series1	12.57	12.07

Table 6: Comparison of VAS score based on procedure.

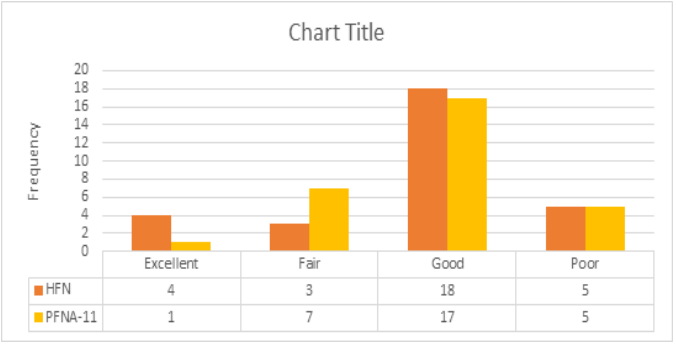
	group	Median	25th -75th quartiles	P value(Mann-Whitney U test)
VAS AT TIME OF ADMISSION	HFN	7.00	7.00-7.25	0.357
	PFN	7.00	7.00-8.00	
VAS AT POST OPERATIVE PERIOD	HFN	6.00	5.00-6.00	0.003
	PFN	6.00	6.00-7.00	
VAS AT ONE WEEK	HFN	3.00	2.00-4.00	0.925
	PFN	3.00	2.00-4.00	

Table 7: Comparison of Modified Harris Hip Score at 0, 6, 12, and 24 weeks.



	0 WEEKS		6 WEEKS		12 WEEKS		24 WEEKS	
Series1	35.77	35.17	56.57	54.93	74.87	63.07	71.1	69.07

Table 8: Comparison result based on procedure at 24th week (HHS).



	Excellent	Fair	Good	Poor
HFN	4	3	18	5
PFNA-11	1	7	17	5

Table 9: Distribution of the patients sample according to complications (general and implant related).

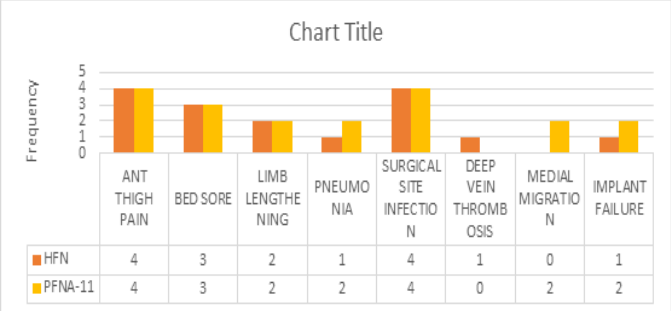
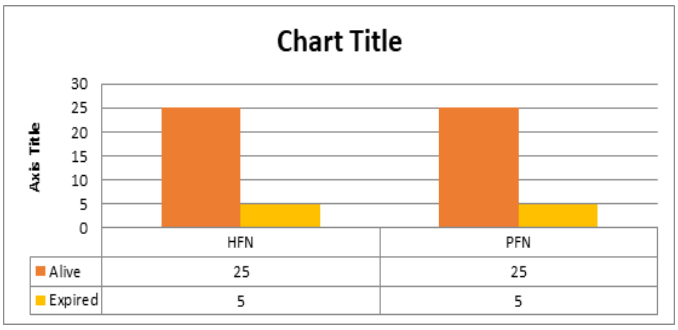


Table 10: Distribution of the patients sample according to mortality.



Discussion

As the world moves forward favoring a sedentary life style coupled with an increase in the average life span, we begin to see its repercussions as well. To reiterate our introductory statement, geriatric hip fractures have become one of the common fractures worldwide. In general, they impose a detrimental impact on both the healthcare system and society. Due to osteoporosis, incidence of intertrochanteric fracture is more in females than in males[1]. Recognizing the undesirable effects has lead to many evolutions to fix the fracture in question. What was once used just for fixation has now transformed to also help the patient achieve optimal mobilization and a better quality of life.

This study was aimed to compare both HFN and PFNA-II for the treatment of intertrochanteric fractures in 60 patients. Overall results showed both HFN and PFNA II perform well, with equally good functional outcomes following fixation. The results suggest that the rate of complications while using HFN was lower than PFNA-II. The number of implant related complications however, is less when a telescopic screw device with additional rotational stability is used, indicating its biomechanical superiority over a helical blade. HFN has a slight superior performance over PFNA-11 in the setting of osteoporosis, which is attributed to compaction of cancellous bone by the telescopic screw. Nevertheless, it must be remembered that no implant design can compensate for poor reduction or poor implant placement in these fractures.

The conclusion derived from this study shows that the use of HFN significantly reduces the possibility of implant related complications along with a slightly better functional outcome when compared to the PFNA II. Although follow up period was not adequate to study long term effects, the results observed at the 6-month mark were satisfactory.

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