



## A Comparative Study of Management of Intertrochanteric Fracture with PFN vs PFN A2

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### ABSTRACT

Intertrochanteric fractures are common injuries, particularly among the elderly population, necessitating effective surgical management for optimal outcomes. This study aimed to compare the efficacy, functional outcomes, and complications of two commonly employed surgical techniques: Proximal Femoral Nail (PFN) and its advanced iteration, Proximal Femoral Nail A2 (PFN A2), in the treatment of intertrochanteric fractures. A prospective comparative study was conducted from May 2022 to May 2023, involving 40 patients with intertrochanteric fractures who were randomly allocated into two groups: PFN (n=20) and PFN A2 (n=20). Parameters evaluated included radiological evidence, surgical variables, intraoperative parameters, achieved reduction, postoperative weight-bearing duration, and complications. Functional outcomes were assessed using the Harris Hip Score (HHS) and Parker Palmer Mobility Score at 3 and 7 months follow-up. Results: The mean patient age was 65.2 years in the PFN group and 68.5 years in the PFN A2 group. The PFN A2 group demonstrated a better mean Harris Hip Score at 3 months (69.31 vs. 65.32) and 7 months (80.24 vs. 77.72) follow-up compared to the PFN group. The PFN A2 group also showed a higher Parker Palmer Mobility Score (7.4 vs. 7.1) and had reduced operative time (46.12 minutes vs. 52.2 minutes) and postoperative blood loss (0.3 gm% reduction vs. 0.5 gm%) compared to the PFN group. Both groups had a low incidence of complications, however, the PFN A2 group had fewer complications compared to the PFN group. The PFN A2 technique demonstrated superior functional outcomes, reduced operative time, and fewer complications compared to the traditional PFN method in the management of intertrochanteric fractures. These findings suggest that PFN A2 may offer improved anatomical restoration, better functional outcomes and fewer complications, making it a preferable choice for treating intertrochanteric fractures. However, further large-scale studies are required to validate these findings and establish PFN A2 as the standard treatment for intertrochanteric fractures.

## INTRODUCTION

Intertrochanteric fractures of the proximal femur are prevalent injuries, particularly among the elderly population, often resulting from traumatic events such as falls or weakened bone density associated with conditions like osteoporosis<sup>[1]</sup>. These fractures are extracapsular and demand a meticulous surgical approach for effective management. Two widely employed methods for the treatment of intertrochanteric fractures are the Proximal Femoral Nail (PFN) and its advanced version, the Proximal Femoral Nail A2 (PFN A2)<sup>[2]</sup>.

The traditional PFN consists of an intramedullary nail, usually made of titanium or a titanium alloy, featuring a proximal lag screw that engages with the femoral head to achieve compression between the fractured fragments. Distal locking screws secure the nail within the femoral shaft. On the other hand, the PFN A2, made of 316L stainless steel, incorporates an intramedullary nail, a helical blade, distal locking bolts, and a top screw<sup>[3]</sup>. It offers improved stability with features such as a helical blade designed to engage with any wedge fragment and overcome lateral cortical impingement. The PFN A2 is available in various diameters and lengths to accommodate different anatomical requirements.

While the PFN has shown superiority over extramedullary devices for unstable intertrochanteric fractures, it is associated with complications like screw cut-out, z effect, reverse z effect, and varus collapse. The PFN A2, with its advanced design, aims to address these challenges, offering enhanced stability and reduced risks of complications<sup>[4]</sup>. This comparative study aims to evaluate the characteristics, advantages, and potential drawbacks of PFN and PFN A2, focusing on surgical technique, postoperative complications, and functional outcomes to provide insights into their efficacy in the treatment of intertrochanteric fractures.

## MATERIALS AND METHODS

A prospective comparative study was conducted from May 2022 to May 2023, involving 40 patients diagnosed with intertrochanteric fractures. The participants were randomly allocated into two groups: the Proximal Femoral Nail (PFN) group (n=20) and the Proximal Femoral Nail A2 (PFN A2) group (n=20). Patients aged 50 years and above with closed unstable intertrochanteric fracture of the femur according to the AO classification and willing to undergo treatment and provide informed and written consent were included in the study. Non-ambulatory patients before the injury and patients with pre-existing osteoarthritis of the hip before the fracture were excluded.

Closed reduction internal fixation was performed on all patients using a traction table. The surgical variables and intraoperative parameters were

recorded for both groups. Isometric and range of motion exercises were initiated from either postoperative day one or day two. Post-operative anteroposterior (AP) and cross-table lateral view X-rays were taken on day 3 to assess the reduction and implant positioning. Sterile dressing was performed on post-operative day 3, day 6 and day 10. Sutures were removed between post-operative-days 10 and 12.

All patients were followed up at 6 weeks, 3 months and 7 months postoperatively. Functional outcomes were assessed using the Harris Hip Score (HHS) at 3 and 7 months follow-up. Clinically, patients were evaluated for any fresh complaints, general physical examination findings, local examination findings, and Modified Harris Hip Score. Radiologically, patients were assessed for the presence of the implant and any fracture-related complications.

Outcome Measure includes Radiological evidence including an X-ray pelvic with both hip joints in AP view and an X-ray of the affected femur in AP and lateral views, achieved reduction during the surgical procedure, postoperative weight-bearing duration, incidence and types of complication, Functional outcomes using the Harris Hip Score at 3 and 7 months follow-up.

Data analysis was performed using appropriate statistical tests to compare the outcomes between the PFN and PFN A2 groups. Descriptive statistics were used to summarize the demographic and clinical characteristics of the participants. Continuous variables were compared using the t-test or Mann-Whitney U test, and categorical variables were compared using the chi-square test or Fisher's exact test. A  $p < 0.05$  was considered statistically significant.

## RESULTS AND DISCUSSIONS

In this prospective comparative study conducted from May 2022 to May 2023, a total of 40 patients diagnosed with intertrochanteric fractures were included and randomly allocated into two groups: the Proximal Femoral Nail (PFN) group (n=20) with a mean patient age of 65.2 years, and the Proximal Femoral Nail A2 (PFN A2) group (n=20) with an average age of 68.5 years.

Intraoperative parameters, including surgical duration and blood loss, were meticulously calculated for both groups. The postoperative period was marked by complications in 3 patients from the PFN group and 1 patient from the PFN-A2 group. The parameters evaluated for comparison between the two groups comprised the neck-shaft angle, type of reduction achieved during surgery, operative time duration, and the Harris Hip Score (HHS). The HHS was utilized as a functional outcome measure and was assessed at 3 and 7 months follow-up to determine the postoperative functional recovery of the patients.

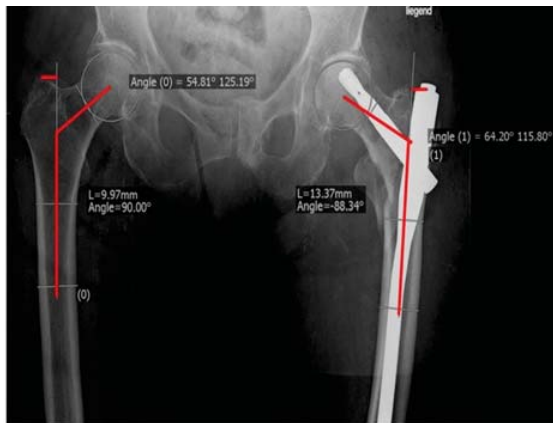


Fig. 1: Neck shaft angle in the immediate postoperative pelvis with bilateral hip radiographs

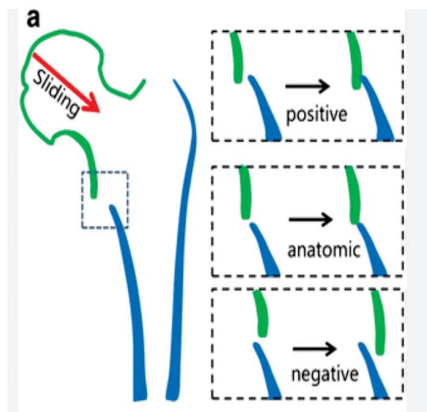


Fig.2: Type of reduction used

Table 1: Comparison of Harris Hip Score

Harris hip score	PFN	PFN A2
3 Months	65.32	69.31
7 months	77.72	80.24

Table 2: Comparative Analysis of Surgical Parameters between PFN and PFN A2 Groups

	PFN	PFN A2
Operative time	52.2	46.12
Blood loss reduction in HB (gm%) post operatively	0.5	0.3

In the comparative analysis between the Proximal Femoral Nail (PFN) and Proximal Femoral Nail A2 (PFN A2) groups, the mean neck-shaft angles achieved were closely aligned, with the PFN group averaging 130.62 degrees and the PFN A2 group averaging 130.6 degrees. These comparable angles indicate consistent and similar anatomical reductions and fixation across both groups, suggesting that both techniques effectively restored the anatomical alignment of the proximal femur. The minimal difference in the mean neck-shaft angles between the two groups underscores the precision and reliability of both the PFN and PFN A2 methods in achieving optimal surgical outcomes for intertrochanteric fractures.

In the comparative assessment of the type of reduction achieved between the Proximal Femoral Nail (PFN) and Proximal Femoral Nail A2 (PFN A2) groups, positive reduction was observed in 57.6% of patients in the PFN group, slightly less than the 63.5% in the PFN A2 group. Neutral reduction was reported in 22.8% of the PFN group compared to 25.2% in the PFN A2 group. Notably, a negative reduction was more prevalent in the PFN group at 19.6%, whereas it was notably lower at 11.3% in the PFN A2 group. These findings suggest that the PFN A2 technique may offer a slightly higher rate of positive reduction and a reduced incidence of negative reduction compared to the traditional PFN method, potentially indicating improved anatomical alignment and better surgical outcomes with the PFN A2 approach.

In the evaluation of functional outcomes using the Harris Hip Score (HHS) at 3 and 7 months follow-up, the Proximal Femoral Nail (PFN) group demonstrated a HHS of 65.32 at 3 months and 77.72 at 7 months. In comparison, the Proximal Femoral Nail A2 (PFN A2) group exhibited slightly higher scores with a HHS of 69.31 at 3 months and 80.24 at 7 months. These results indicate a gradual improvement in functional outcomes over time for both groups. The PFN A2 group consistently showed better functional recovery and higher HHS values at both 3 and 7 months follow-up compared to the PFN group, suggesting that the PFN A2 technique may offer improved postoperative functional outcomes and a potentially faster recovery compared to the traditional PFN method.

In the comparative analysis of surgical parameters between the Proximal Femoral Nail (PFN) and Proximal Femoral Nail A2 (PFN A2) groups, the PFN group had an average operative time of 52.2 min, slightly longer than the 46.12 min in the PFN A2 group. Regarding postoperative blood loss reduction in hemoglobin (gm%), the PFN group showed a reduction of 0.5 gm%, whereas the PFN A2 group demonstrated a slightly better reduction of 0.3 gm%. These findings suggest that the PFN A2 technique may offer advantages in terms of reduced operative time and slightly improved control over postoperative blood loss compared to the traditional PFN method.

In the assessment of postoperative functional mobility using the Parker Palmer Mobility Score, the Proximal Femoral Nail A2 (PFN A2) group achieved an average score of 7.4, slightly higher than the average score of 7.1 obtained by the Proximal Femoral Nail (PFN) group. This suggests that the PFN A2 technique may provide a slight advantage in postoperative mobility and functional recovery compared to the traditional PFN method.

In the evaluation of postoperative complications between the Proximal Femoral Nail (PFN) and Proximal Femoral Nail A2 (PFN A2) groups, both groups

experienced a similar incidence of superficial infections, each with one case reported. However, the PFN group had one case of medial migration or reverse Z effect and one intraoperative complication, while the PFN A2 group had one case of implant breakage and no intraoperative complications. These findings suggest that while both techniques have a relatively low rate of complications, the PFN A2 method may offer certain advantages in terms of reduced implant-related complications and intraoperative issues compared to the traditional PFN method.

The management of intertrochanteric fractures remains a significant challenge in orthopedic surgery, particularly among the elderly population where these fractures are most prevalent. This study aimed to compare the outcomes and complications associated with two commonly used surgical techniques: the Proximal Femoral Nail (PFN) and its advanced version, the Proximal Femoral Nail A2 (PFN A2)<sup>[5]</sup>. Our study revealed several important findings. In terms of anatomical restoration, both the PFN and PFN A2 groups demonstrated comparable mean neck-shaft angles, with the PFN group averaging 130.62 degrees and the PFN A2 group averaging 130.6 degrees. However, the type of reduction achieved differed slightly between the two groups. A positive reduction was observed in 57.6% of patients in the PFN group and 63.5% in the PFN A2 group. Furthermore, the PFN A2 group exhibited a lower incidence of negative reduction (11.3%) compared to the PFN group (19.6%)<sup>[6]</sup>.

Functional outcomes were assessed using the Harris Hip Score (HHS) and the Parker Palmer Mobility Score. The PFN A2 group showed better functional recovery with higher HHS scores at both 3 and 7 months follow-up (69.31 and 80.24, respectively) compared to the PFN group (65.32 and 77.72, respectively). Additionally, the PFN A2 group had a higher average Parker Palmer Mobility Score of 7.4 compared to 7.1 in the PFN group, indicating improved postoperative mobility and functional recovery with the PFN A2 technique. NathAdulkasem *et al* emphasizes the importance of the patients' preinjury clinical status, which outweighs the surgical-related factors in predicting postoperative functional outcomes of older patients with an intertrochanteric fracture. Pre-injury ambulatory status is the strongest independent predictor, followed by the patient's BMI<sup>[7]</sup>. Surgical parameters such as operative time and postoperative blood loss reduction were also analyzed. The PFN A2 technique demonstrated advantages in reduced operative time (46.12 minutes) compared to the traditional PFN method (52.2 minutes) and slightly better control over postoperative blood loss (0.3 gm% reduction) compared to the PFN group (0.5 gm%). Regarding complications, both groups had a relatively

low incidence of complications. The PFN A2 group had one case of implant breakage and no intraoperative complications, while the PFN group experienced one case each of medial migration or reverse Z effect, superficial infection and intraoperative complication<sup>[8,9]</sup>. The findings of this study are consistent with previous literature suggesting that PFN A2 offers advantages over the traditional PFN method in terms of improved anatomical reduction, better functional outcomes, and reduced surgical complications. The advanced design features of PFN A2, such as the helical blade and improved implant design, contribute to its better performance and outcomes compared to PFN3<sup>[10]</sup>.

## CONCLUSION

In conclusion, the PFN A2 technique appears to be a superior alternative to the traditional PFN method for the management of intertrochanteric fractures, offering improved anatomical restoration, better functional outcomes, and fewer complications. However, further large-scale randomized controlled trials are required to validate these findings and establish PFN A2 as the standard treatment for intertrochanteric fractures.

**Limitation:** One of the limitations of our study is the relatively small sample size, which may limit the generalizability of the findings to a broader population. Additionally, the study duration was limited to one year, which might not capture the long-term outcomes and complications associated with the PFN and PFN A2 techniques. Further, the study did not consider other potential confounding variables such as patient comorbidities, bone quality and surgeon experience, which could influence the surgical outcomes and complications. Therefore, larger multi center randomized controlled trials with longer follow-up periods and consideration of various confounding factors are needed to confirm the superiority of PFN A2 over PFN in the management of intertrochanteric fractures.

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