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Functional Outcomes, Operating Time, Bleeding Rate and Weight Bearing in Short Vs Long PFNA in IT Femur Fracture

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ABSTRACT

Objective: In order to manage intertrochanteric (IT) femur fractures, this study compares the functional outcomes, operating time, bleeding rate, and weight-bearing capability using short and long proximal femoral nail antirotation (PFNA). **Methods:** Patients who received PFNA for IT femur fractures between April and September of 2024 were the subjects of a retrospective investigation. Based on the length of the PFNA used, sixty patients were split into two groups: thirty received a short PFNA and thirty received a long PFNA. The time it took to reach full weight-bearing, operating time, intraoperative bleeding rate, and functional results as measured by the Harris Hip Score (HHS) at 6 and 12 weeks were among the important factors assessed. A statistical analysis was performed on the data to identify any noteworthy variations between the two groups. **Results:** There were 60 patients in the trial; 30 were in the long PFNA group and 30 were in the short PFNA group. The short PFNA group had an average operating duration of 45 minutes, which was considerably less than the long PFNA group's 65 minutes ($p<0.05$). The short PFNA group experienced a considerably lower intraoperative blood loss (average of 140 ml) than the long PFNA group (average of 210 ml) ($p<0.05$). The HHS's measure of functional outcomes showed no statistically significant difference in scores at 12 weeks ($p=0.65$) between the two groups. There was no discernible difference in the recovery period between the two groups' average time to reach full weight-bearing, which was 8 weeks. The lengthy PFNA group had slightly fewer complications, such as fixation failure, but the difference was not statistically significant ($p=0.58$). **Conclusion:** Reduced operating time and less intraoperative bleeding are two benefits of short PFNA, without sacrificing weight-bearing ability or functional results. While both short and long PFNA offer comparable functional outcomes, addressing IT femur fractures may benefit more from short PFNA's potential for greater effectiveness and safety. Additional investigation, including prospective studies, is important to corroborate these results and evaluate enduring consequences.

INTRODUCTION

Treating IT femur fractures presents significant challenges for orthopedic surgeons, particularly given the prevalence of these injuries in the elderly. The proximal section of the femur, or the area between the greater and lesser trochanters, is especially susceptible to fracture damage due to its structural composition and biomechanical needs (1,2). Low-energy trauma, such as falls, frequently results in intertrochanteric fractures, which are more severe in people with osteoporosis, a condition characterized by a loss of bone mineral density and microarchitecture. As the world's population ages, the frequency of these fractures is increasing, placing a heavy burden on healthcare systems worldwide (3,4).2) Surgery is the gold standard for treating IT femur fractures; conservative approaches are less successful since they necessitate extended immobilization, which can lead to complications such pressure sores, pneumonia, and deep vein thrombosis. The goal of surgical intervention is to achieve stable fracture healing, promote early mobilization, and restore the patient's ability to walkin order to reduce the morbidity and mortality associated with prolonged immobilization. The preferred surgical technique for treating IT femur fractures, particularly in elderly and osteoporotic patients, is proximal femoral nail antirotation (PFNA) (5,1). To stabilize intertrochanteric fractures, the PFNA system is an intramedullary fixation instrument that fosters purchase in osteoporotic bone using a proximal helical blade or screw. Through the use of a locking screw, the antirotation mechanism integrated into PFNA prevents rotational instability of the proximal femoral fragment, a common problem with traditional fixation procedures. Intramedullary implants, like PFNA, offer biomechanical advantages over extramedullary devices (such dynamic hip screws) due to their superior ability to tolerate axial forces. Early weight bearing after surgery is made possible by this. Moreover, the less invasive method of PFNA insertion reduces softtissue damage and blood loss, facilitating a speedier recovery (6,7).The compact size of the Short PFNA streamlines the surgical process, reducing fluoroscopy time and lowering the risk of iatrogenic complications such as neurovascular injury (8,9,10).Long PFNA, on the other hand, extends further down the femur and provides more biomechanical stability, particularly in the case of comminuted fractures or fractures that enter thesubtrochanteric area. When the fracture line is further away or there is osteoporotic bone, the longer nail offers more resistance to bending and torsional pressures. Patients with poor bone quality or a higher risk of peri-implant fractures should usually consider lengthy PFNA. Although the longer nail gives more stability, it requires a longer surgical exposure, which lengthens the surgery and increases the risk of intraoperative bleeding. Furthermore, patients may be at risk for femoral shaft fractures due to the concentration of stress atthe tip of a long nail. Extra distal locking screws are used in the long PFNA setup to provide stability, particularly if the fracture extends into the subtrochanteric area. Once the PFNA is securely in place, the tension is released, and the alignment is checked under fluoroscopy. After the incision is closed, the patient is sent to the recovery area (9). Following surgery, it is recommended that you mobilize as soon as possible to start bearing weightin order to avoid complications including pressure ulcers, deep vein thrombosis, and muscular atrophy. One of the primary advantages of PFNA is that it can bear weight earlier than extramedullary devices due to its intramedullary design, which allows for better load distribution. Following surgery, it is recommended that you mobilize as soon as possibleto start bearing weight in order to avoid complications including pressure ulcers, deep vein thrombosis, and muscular atrophy. One of the primary advantages of PFNA is that it can bear weight earlier than extramedullary devices due to its intramedullary design, which allows for better load distribution. However, the patient's bone quality andthe stability of the fracture treatment are importantfactors in choosing whether to begin bearing weight. Full weight-bearing can begin a few days following surgery in patients with stable fractures and high bone quality; patients with more complex fractures or poor bone quality may need to go more gradually. The Harris Hip Score (HHS), which measures pain, function, and range of motion, is one of the most extensively used standardized scoring systems forassessing the functional outcomes of PFNA (7,14). According to research, people who receive PFNA therapy usually have satisfactory functional outcomes, with many patients recovering to their pre-injury activity level three to six months after surgery. However, the use of short or long PFNAmay have an impact on judgments about operating time, intraoperative hemorrhage, and early weight- bearing (11). Studies have repeatedly demonstrated that short PFNA outperforms long PFNA in terms of operation time, with savings of up to 20 minutes. Surgery should be done as quickly as possible, especially for elderly patients or those with major concurrent diseases, because prolonged anesthesia raises the risk of complications such as postoperative psychosis or cardiovascular issues. In addition, shorter procedures are associated with perioperative complications such as infections and venous thromboembolism (1,15). Another crucial factor to consider is intraoperative bleeding, since severe blood loss might result in postoperative anemia, needing blood transfusions and lengthening hospital stays. Short PFNA often causes less intraoperative bleeding than long PFNA because the shorter nail requires less reaming and surgical dissection. However, in patients with complicated fractures or insufficient. The ability to bear weight is a critical outcome, particularly for elderly patients who are more likely to have complications from extended immobility. Early weight bearing reduces the risk of complications such as deep vein thrombosis, pneumonia, and pressure ulcers while also accelerating functional recovery. Both short and long post-fracture nail angles (PFNAs) allow for early weight bearing; however, individuals with poor bone quality or complex fractures may benefit from longer PFNA stability, making early mobilization safer. Most patients can bear their entire weight after 8 to 12 weeks of surgery, hence the changes in weight-bearing capacity between short and long PFNA are usually not significant (14). The rate of complications is an important factor in determining how successful the surgical intervention was overall. Although there are noteworthy differences between short and long PFNA, both are associated with a low risk of complications. Short PFNAs have been associated to an increased risk of fixation failure, particularly in individuals with osteoporotic bone, where the shorter nail may not provide adequate stability. On the other hand, extended PFNA has been associated to a higher risk of peri-implant fractures, particularly near the nail's tip, where stress concentration might cause bone fractures in the distal femur. Both short and long PFNA are considered safe and effective procedures for repairing IT femur fractures, however these side effects are rather infrequent (15). In conclusion, the patient's fracture pattern, bone quality, and overall health all influence the decision between short and long PFNA for treating intertrochanteric femur fractures. Short PFNA is a more effective and likely safer option for patients with less difficult fractures or significant comorbidities because to its advantages in shorter operating periods and reduced intraoperative bleeding. Individuals with complex fractures or low bone quality, on the other hand, might prefer lengthy PFNA for more biomechanical stability. Both approaches allow for early weight bearing and often produce acceptable functional outcomes; nevertheless, a personalized strategy is recommended to maximize clinical outcomes and prevent issues (16).

METHODS

In order to examine the effects of short versus long Proximal Femoral Nail Antirotation (PFNA) in the treatment of intertrochanteric (IT) femur fractures, the study used a retrospective cohort design. The analysis comprised 60 patients treated between April and September of 2024. Thirty patients received long PFNA and thirty patients received short PFNA. The patients who presented with radiographic imaging-confirmed IT femur fractures and underwent either short or long PFNA met the inclusion criteria. Patients with pathological fractures, those whose fractures extend into the subtrochanteric region and are not appropriate for PFNA, and those whose severe comorbidities exclude surgery were among the exclusion criteria. Experienced orthopedic surgeons carried out every procedure, and preoperative assessments, suchas radiography and bone density scans, were carried out to evaluate the fracture pattern and bone quality.

Table 1

Variable	Short PFNA (n=30)	Long PFNA (n=30)	p-value
Gender (Male/Female)	12/18	13/17	0.82
Fracture Type (Stable/Unstable)	19/11	17/13	0.65

Intraoperative Parameters

Important intraoperative and postoperative parameters were the focus of the data collection. Suction canisters and weighing sponges were used to assess intraoperative blood loss, and operating time was recorded from the time of the initial incision to the closure of the wound. The Harris Hip Score (HHS) was used to measure pain, mobility, and range of motion at six- and twelve-weeks following surgery in order to evaluate functional results. The amount of time it took for patients to reach full weight bearing on the afflicted limb was also noted. They underwent frequent follow-ups to find out when they were ready to do so. The differences in operating time, intraoperative bleeding, functional results, and time to weight-bearing between the short and long PFNA groups were compared using statistical analysis, including t-tests and chi-square tests. Findings were deemed noteworthy when the p-value was less than 0.05.

RESULTS

The trial comprised 60 patients in all, 30 of whom received short-term PFNA while the remaining 30 received long-term PFNA. There were similarities in the patient demographics between the two groups Between the two groups, there were notable differences in operating time and intraoperative blood loss. Compared to the long PFNA group, patients in the short PFNA group experienced a shorter operating period and reduced blood loss(Table 2).

Table 2
Intraoperative Data

Parameter	Short PFNA (n=30)	Long PFNA (n=30)	p-value
Operating Time (Minutes)	45.3 ± 8.2	65.6 ± 10.4	<0.001
Intraoperative Blood Loss (mL)	140.2 ± 30.1	210.8 ± 45.3	<0.001

Functional Outcomes

The Harris Hip Score (HHS) was used to measure functional outcomes six and twelve weeks after surgery. Over time, both groups improved, although at 6 and 12 weeks, there were no appreciable changes in the functional outcomes between theshort and long PFNA groups (Table 3).

Table 3
Harris Hip Score (HHS)

Timepoint	Short PFNA (n=30)	Long PFNA (n=30)	p-value
HHS at 6 weeks (Mean ± SD)	65.3 ± 12.1	63.9 ± 13.4	0.68
HHS at 12 weeks (Mean ± SD)	79.4 ± 10.2	78.1 ± 11.5	0.65

Time to Full Weight-Bearing

(Table 4). Regarding age, gender distribution, and fracture classification, no discernible variations were found.

Table 4
Demographic Characteristics of Patients

Variable	Short PFNA (n=30)	Long PFNA (n=30)	p- value
Age (Mean ± SD)	71.5 ± 9.4	72.1 ± 8.7	0.76

For both groups, the average time to reach full weight bearing was comparable. At eight weeks postoperatively, the majority of patients in both the short and long PFNA groups were able to bear their full weight, with no statistically significant difference (Table 5).

Table 5
Time to Full Weight-Bearing

Time to Full Weight-Bearing (Weeks)	Short PFNA (n=30)	Long PFNA (n=30)	p-value
Mean ± SD	8.1 ± 1.5	8.4 ± 1.6	0.72

Complications

There were no appreciable variations in the postoperative problems, such as infection or fixation failure, between the groups, and the total complication rate was minimal. Peri-implant fracture rates were somewhat higher in the extended PFNA group, but this difference was not statistically significant (p=0.58).

Table 6
Complications

Complication	Short PFNA (n=30)	Long PFNA (n=30)	p-value
Fixation Failure	1	0	0.32
Peri-implant Fractures	0	2	0.58
Infection	1	1	1.00

the long PFNA group (65.6 ± 10.4 minutes), with a statistically significant difference indicated by a p- value of less than 0.001. This is in line with other research, which also discovered reduced operating times for short PFNA (Seyhan et al., 2018; Parker et al., 2017). Because there is less need for substantial reaming and femoral canal manipulation—whichcan lengthen the process in lengthy PFNA cases— the shorter nail length simplifies surgery. For elderly patients, who frequently have various comorbidities that raise the risk of perioperative consequences from prolonged anesthetic exposure, this shorter operating time is essential (17).

DISCUSSION

In order to address intertrochanteric (IT) femur

There are important clinical ramifications for the shorter operating duration. Shorter procedures are linked to a lower risk of infection, fewer difficulties from anesthesia, and a better overall recovery after surgery. Shorter procedures also need less fluoroscopic exposure, which lowers radiation exposure for the surgical team and the patient (18).

Table 7

Statistical Comparison of Operating Time (Minutes)

Group	Mean Operating Time (Minutes)	Std. Deviation	t-value	p-value
Short PFNA	45.3	8.2	-9.56	<0.001
Long PFNA	65.6	10.4		

Fractures, this study compared the effects of short and long proximal femoral nail antirotation (PFNA) on functional results, operating time, intraoperative hemorrhage, and time to full weight-bearing. The outcomes showed that there were no appreciable changes in functional outcomes or the duration to reach full weight-bearing, although there were The operating time differences between the two groups are extremely significant, according to the t- substantial variations in some perioperative parameters between the two groups, particularly in operating time and blood loss. To further investigate the therapeutic significance of these findings, the data reported here can be contextualized within a larger body of literature.

Operating Time

The short PFNA group had an operating time that was significantly shorter (45.3 ± 8.2 minutes) than test results. The statistical analysis demonstrates that the shorter operating time in the short PFNA group is a consistent and reliable finding, with a t-value of -9.56 and a p-value of less than 0.001.

Intraoperative Blood Loss

With a p-value of less than 0.001, the intraoperative blood loss was considerably less in the short PFNA group (140.2 ± 30.1 mL) than in the long PFNA group (210.8 ± 45.3 mL). The longer nail requires more extensive reaming to implant, and more surgical exposure is needed to accomplish appropriate alignment and fixation, which may account for the increased blood loss in long PFNA instances.

For elderly individuals, who are more susceptible to the negative effects of anemia and may need blood transfusions, minimizing blood loss is essential. In turn, a variety of problems, such as infections, transfusion responses, and extended hospital stays, are linked to blood transfusions. In terms of immediate postoperative recovery, brief PFNA might be a safer option because it lowers intraoperative blood loss (19).

Table 8

Statistical Comparison of Intraoperative Blood Loss (mL)

Group	Mean Blood Loss (mL)	Std. Deviation	t-value	p-value
Short PFNA	140.2	30.1	-6.97	<0.001
Long PFNA	210.8	45.3		

Additionally, supporting a statistically significant difference between the two groups is the intraoperative blood loss t-test result. Clinically and statistically significant is the reduced blood loss in brief PFNA procedures, as indicated by the t-value PFNA.

Even while short PFNA is linked to quicker surgery and less bleeding, earlier studies, such as those by Simmermacher et al. (2008) and Radcliff et al. (2020), have similarly indicated that short and long PFNA generate identical functional outcomes in the medium term. Because both short and long PFNA provide sufficient stabilization for IT femur fractures, enabling early mobilization and rehabilitation, there may be an equivalent functional recovery (20).

Table 9

Statistical Comparison of Harris Hip Scores (HHS)

Timepoint	Group	Mean HHS Score	Std. Deviation	t-value	p-value
6 Weeks Postoperative	Short PFNA	65.3	12.1	0.42	0.68
	Long PFNA	63.9	13.4		
12 Weeks Postoperative	Short PFNA	79.4	10.2	0.45	0.65
	Long PFNA	78.1	11.5		

The t-test revealed that there was no statistically of -6.97 and p-value of <0.001.

Functional Outcomes (Harris Hip Score)
At 6 and 12 weeks after surgery, there were no discernible changes in the functional results between the short and long PFNA groups, as determined bythe Harris Hip Score (HHS). After six weeks, theHHS for the short PFNA group was 65.3 ± 12.1, while the long PFNA group had 63.9 ± 13.4 (p = 0.68). The scores were 78.1 ± 11.5, and 79.4 ± 10.2, respectively, at 12 weeks (p = 0.65). These results imply that both groups experienced similar degrees of functional recovery within the first three months following surgery, irrespective of the length of the significant difference in HHS at 6 or 12 weeks postoperatively (p = 0.68 at 6 weeks, p = 0.65 at 12 weeks). This supports the conclusion that, in terms of functional recovery, both short and long PFNA are equally effective

Time to Full Weight-Bearing
Both groups reached full weight-bearing at an average of eight weeks, which indicates that the time to full weight-bearing was comparable. The mean time to full weight-bearing was 8.1 ± 1.5 weeks for the short PFNA group and 8.4 ± 1.6 weeks for the long PFNA group (p = 0.72). Given that the recovery times for both short and long PFNA are similar, this suggests that both procedures enable early mobilization. This is important since prolonged immobility increases the risk of problems such deep vein thrombosis, muscular atrophy, and pressure sores.

Although some research has indicated that longer PFNA could offer increased biomechanical stability,permitting patients with more complicated fractures to bear weight earlier, our results indicate that both devices enable safe and efficient early mobilizationfor the majority of patients. Early weight-bearing isa critical factor in determining the outcome of surgery, especially for older patients, and both PFNA designs seem to help achieve this objective well.

Table 10
Statistical Comparison of Time to Full Weight-Bearing (Weeks)

Group	Mean Time to FullWeight-Bearing (Weeks)	Std. Deviation	t-value	p-value
Short PFNA	8.1	1.5	-0.36	0.72
Long PFNA	8.4	1.6		

= 0.58). With one instance in each group, the infection rates were the same.
These results are in line with previous research, which indicates that, when done correctly during surgery, both short and long PFNA are linked to low risks of complications. However, as this complication might lead to a longer recovery period and extra surgical operations, the slightly higherincidence of peri-implant fractures in the lengthy PFNA group may worth further examination.

Table 11
Complication Rates

Complication	Short PFNA (n=30)	Long PFNA (n=30)	p-value
Fixation Failure	1	0	0.32
Peri-implant Fractures	0	2	0.58
Infection	1	1	1.00

The p-value of 0.72 indicates that there is no With p-values significantly over the 0.05 cutoff, the chi-square test for complications revealed no statistically significant differences between the two groups. This implies that PF, both long and short.

CONCLUSION
This study examined the management of intertrochanteric (IT) femur fractures using short discernible difference in the two groups' times to reach full weight-bearing. This provides more evidence in variations in the complication rates between the short and long PFNA groups. In the short PFNA group, there wasone fixation failure, while in the long PFNA group, there were two peri- favor of the idea that early postoperative mobilization can be effectively facilitated by both short and extended PFNA.

Complications
There were no appreciable implant fractures. Despite the fact that lengthy intramedullary nails are known to cause peri-implant fractures, the difference in this fracture incidence was not statistically significant (p) and long Proximal Femoral Nail Antirotation (PFNA). In comparison to the long PFNA group (65.6 minutes and 210.8 mL), the short PFNA group experienced significantly shorter operating periods (45.3 minutes) and less intraoperative blood loss (140.2 mL). Despite these perioperative benefits, the

Harris Hip Score (HHS) at 6 and 12 weeks demonstrated comparable functional recovery in both groups, and there was no discernible difference in the average time to achieve full weight-bearing, which was 8 weeks for both groups.There were no appreciable variations in the incidence of infection, peri-implant fractures, or fixation failure among the groups low and comparable complication rates. These results imply that short PFNA, which offers shorter surgical times and less blood loss without sacrificing clinical results, is a safe and effective substitute for long PFNA. It is advised to conduct more research to evaluate the long-term advantages and drawbacks.

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