ORIGINAL ARTICLE

Comparison of clinical outcomes of patients treated with proximal femoral nail and proximal femoral anatomic plate in upper-end fractures of the femur: A multicenter study

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ABSTRACT

BACKGROUND: The aim of this study is to compare the clinical results of proximal femoral nail (PFN) and proximal femoral anatomic plate (PFA) methods used in the treatment of proximal femoral fractures through a multicenter retrospective review, and to determine which method is more advantageous for specific patient groups. The study aims to evaluate the effectiveness of PFN and PFA techniques and presents findings that can guide clinical decision-making by revealing the differences between these two methods.

METHODS: Between 2016 and 2021, 106 patients with proximal femur fractures classified as type 31A1 and 31A2 according to the AO/OTA (the Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association) classification system were retrospectively examined. Patients were treated with either PFN or PFA, and the clinical results were compared. The variables evaluated included Oxford Hip Score, time to surgery, operation time, hospital stay, blood loss, and follow-up duration. Statistical analyses were performed using the chi-square test, independent-samples t-test, and Mann-Whitney U test.

RESULTS: When the clinical outcomes of patients treated with PFN and PFA were compared, the PFN group had shorter operation time and less blood loss than the PFA group, and this difference was statistically significant ($p<0.05$). In addition, hospital stay was shorter in the PFN group, also showing a statistically significant difference ($p<0.05$). No significant difference was found between the two groups regarding follow-up duration ($p>0.05$). However, the Oxford Hip Score was higher in the PFN group compared to the PFA group, indicating better postoperative functional results ($p<0.05$). Analyses by age and comorbidities showed no statistically significant differences between the groups ($p>0.05$).

CONCLUSION: Patients who underwent PFN had advantages such as shorter surgical time, less blood loss, and shorter hospital stay compared to patients who underwent PFA. In this context, PFN can be considered superior in terms of clinical outcomes, as it is less invasive and allows faster recovery. However, no significant difference was observed in follow-up duration.

Keywords: Femur fracture; hip fracture; proximal femoral nail; proximal femoral anatomic plate.

INTRODUCTION

Proximal femur fractures, particularly intertrochanteric AO/OTA (the Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association) 31A1 and 31A2 patterns, are a significant global health concern. They are among the leading causes of morbidity and mortality in elderly patients, resulting in impaired mobility, reduced independence, and a substantial socioeconomic burden.[1-3] The worldwide incidence of hip fractures is expected to rise dramatically, from 2.6 million cases in 2025 to more than 6.2 million by 2050, paralleling population aging.[4,5]

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Accurate classification of fracture morphology is essential for surgical decision-making. According to the AO/OTA system, 31A1 fractures are generally stable two-part patterns with an intact lateral cortex, whereas 31A2 fractures are unstable and multifragmentary, often involving lateral wall comminution that complicates fixation and prolongs healing.[6] This heterogeneity necessitates implant selection tailored to bone quality and biomechanical demands.

Surgical fixation remains the gold standard for displaced proximal femur fractures, aiming to restore alignment, enable early mobilization, and reduce complications.[7] Among fixation options, the proximal femoral nail (PFN) provides intramedullary stabilization through a minimally invasive approach, with meta-analyses reporting shorter operative times and lower intraoperative blood loss compared to open extramedullary techniques.[8,9] Nevertheless, implant-related complications such as lag screw cut-out and implant breakage remain problematic, particularly in osteoporotic bone and unstable fracture types.[10,11]

By contrast, the proximal femoral anatomic plate (PFA) is an extramedullary locking plate designed to conform to proximal femoral anatomy. It offers direct lateral buttressing, potentially improving stability in comminuted fractures, but its application requires a larger incision, more extensive soft-tissue dissection, longer operative time, and greater blood loss, often leading to higher transfusion requirements.[12-13] Advocates suggest it may reduce varus collapse and implant migration in highly unstable constructs.

Previous studies comparing these two methods have shown that PFN often enables earlier ambulation and superior early hip scores, although long-term outcomes tend to converge after 12 months.[14-17] However, the available literature is limited by small sample sizes, short follow-up durations, and predominantly single-center designs, restricting statistical power and external validity.[17-20]

To address these limitations, we conducted a retrospective multicenter study of 106 patients with AO/OTA 31A1–31A2 intertrochanteric fractures treated with either PFN or PFA between 2016 and 2021, with a minimum follow-up of 36 months.[20] The study was designed to compare perioperative invasiveness, functional recovery, and long-term complications, as well as to evaluate outcomes in elderly and comorbid patients.

Hypotheses:

• H1: PFN will yield shorter operative times, smaller incisions, and less blood loss than PFA, leading to faster functional recovery.

• H2: Over a ≥3-year follow-up, there will be no significant difference in late complications or implant failures between PFN and PFA groups.

• H3: In elderly and comorbid subgroups, PFN will be associated with lower mortality and morbidity due to its minimally invasive approach.

MATERIALS AND METHODS

Study Design and Ethical Approval

This retrospective, multicenter cohort study was conducted using patient data from January 2016 to December 2021, obtained by searching the archives of two tertiary referral hospitals (Kütahya Health Sciences University and Yavuz Selim Orthopedic Diseases and Rehabilitation Hospital). The protocol was approved by the Institutional Review Boards of both centers (Kütahya Health Sciences University Ethics Committee, approval no. 2021/05-10, dated 15.02.2021). All procedures were performed in accordance with the Declaration of Helsinki, and patient consent was not obtained due to the retrospective design. All procedures conformed to the Declaration of Helsinki, and patient consent was waived due to the retrospective design.

Patient Selection and Grouping

We screened all patients who underwent surgical fixation for AO/OTA 31A1 (simple two-part) or 31A2 (multifragmentary) intertrochanteric femur fractures during the study period.

Inclusion Criteria:

• Age ≥ 18 years

• Isolated AO/OTA 31A1 or 31A2 proximal femur fracture

• Treatment with either PFN or PFA

• Minimum clinical and radiographic follow-up of ≥ 36 months

Exclusion Criteria:

• Pathological or open fractures

• Multiple trauma or polytrauma

• Prior ipsilateral hip surgery

• Neuromuscular disorders (hemiplegia, quadriplegia)

• Refusal of treatment or incomplete records.

Allocation to the PFN or PFA group was based solely on the operating surgeon's clinical judgment, considering factors such as fracture pattern (lateral wall integrity), bone quality, and patient comorbidities. Both implants were deemed technically feasible in all included cases, minimizing selection bias.

Surgical Techniques

PFN group: Closed reduction was performed on a traction table under fluoroscopic guidance. A 3–5 cm lateral skin incision was made over the greater trochanter. After splitting the fascia lata, a guidewire was introduced into the femoral canal, sequential reaming was performed, and a cephalomedullary nail was inserted. A single lag screw and two distal locking bolts were placed through stab incisions.

PFA group: Patients were positioned in the lateral decubitus position. A 10–12 cm lateral incision was made, dissecting through the iliotibial band and vastus lateralis to expose the lateral cortex. The anatomically contoured proximal femoral plate was applied and fixed with a combination of locking and cortical screws, including at least one cephalomedullary lag screw. Wound closure was performed in layers.

All surgeons followed standardized perioperative antibiotic prophylaxis and thromboprophylaxis protocols.

Definition and Measurement of Key Variables

• Incision length: Measured intraoperatively (cm) from skin edge to skin edge using a sterile ruler.

• Operative time: From skin incision to final skin suture (minutes), recorded in the anesthetic record.

• Intraoperative blood loss: Calculated as (suction canister volume – irrigation fluid volume) + [(wet sponge weight – dry sponge weight)/1 g per mL].

• Soft-tissue injury surrogate: Documented as the length of fascial and muscular dissection (cm) recorded in operative notes.

• Transfusion requirements: Number of packed red blood cell units transfused intra- or postoperatively.

Functional and Radiographic Outcomes

• Radiographic union: Defined as bridging trabeculae on at least three cortices on anteroposterior (AP) and lateral hip radiographs. Assessed at 6 weeks, 3 months, 6 months, and 12 months postoperatively.

• Oxford Hip Score (OHS) and Hip Pain Severity Score: Collected by trained study nurses at 6 months, 12 months, 24 months, and final follow-up.

• Time to independent ambulation: Days from surgery until the patient could ambulate unaided with full weight-bearing, as documented in physical therapy notes.

• Long-term complications: Incidence of post-traumatic osteoarthritis (Kellgren–Lawrence grade ≥2), periprosthetic fracture, implant failure, or reoperation, tracked through clinical follow-up and imaging over ≥36 months.

Data Collection and Quality Control

Two independent reviewers at each site extracted data into a standardized electronic form. Discrepancies were resolved by consensus or by a third reviewer. Collected variables included demographics (age, sex), comorbidities (Charlson Comorbidity Index, ASA [American Society of Anesthesiologists] score), fracture classification, perioperative metrics, and outcome measures.

Statistical Analysis

Analyses were performed using SPSS v23.0 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro-Wilk test. Normally distributed data are reported as mean ± standard deviation (SD) and compared using the independent-samples t-test; non-normally distributed data are reported as median (interquartile range, IQR) and compared using the Mann-Whitney U test. Categorical variables are presented as counts and percentages and compared using the chi-square or Fisher's exact test. A two-tailed $p<0.05$ was considered statistically significant. Subgroup analyses adjusting for surgeon experience and study center were planned using multivariate logistic regression models.

RESULTS

In this study, the demographic characteristics and clinical outcomes of patients treated with PFN and the plate method were compared. The effects of both treatment methods on healing time, complications, and outcomes were analyzed. Demographic characteristics are shown in Table 1.

Table 1. Demographic and comorbidity characteristics of patients treated with proximal femoral nail (PFN) and proximal femoral anatomic plate (PFA)

Variables	PFN Group n (%)	PFA Group n (%)	p value
Gender (Male)	24 (44.4)	30 (57.7)	p>0.05
Gender (Female)	30 (55.6)	22 (42.3)	p>0.05
≤65 years	13 (24.1)	15 (28.8)	p>0.05
≥66 years	41 (75.9)	37 (71.2)	p>0.05
Right-sided surgery	28 (51.9)	23 (44.2)	p>0.05
Left-sided surgery	26 (48.1)	29 (55.8)	p>0.05
Hypertension	20 (37)	15 (28.8)	p>0.05
Heart disease	16 (29.6)	11 (21.2)	p>0.05
Diabetes mellitus (DM)	7 (13)	5 (9.6)	p>0.05

*Chi-square test was applied. **p≤0.05 was considered statistically significant.

Table 2. Comparison of preoperative and postoperative clinical outcomes between proximal femoral nail (PFN) and proximal femoral anatomic plate (PFA) groups

Variables	PFN Group (Mean±SD)	PFA Group (Mean±SD)	p value
Oxford Hip Score	86.52±4.63	61.12±10.86	p<0.05
Time to surgery (days)	3.04±1.98	3.90±2.80	p>0.05
Operation time (minutes)	37.81±12.85	74.67±19.12	p<0.05
Duration of hospitalization (days)	4.76±2.17	6.52±4.25	p<0.05
Blood loss (cc)	113.89±52.32	481.92±265.32	p<0.05
Follow-up period (months)	32.41±6.83	33.83±4.58	p>0.05

*Mann-Whitney U test was used. **p≤0.05 was considered statistically significant.

According to the findings in Table 1, the distribution of patients treated with PFN and the plate method was similar in terms of gender, age, and operated side. Among patients treated with PFN, 44.4% were male and 55.6% were female, while in the plate group 57.7% were male and 42.3% were female. There was no significant difference between the two groups in gender distribution (p>0.05). When the age distribution was analyzed, 24.1% of patients in the PFN group were 65 years of age or younger and 75.9% were 66 years or older, while these rates were 28.8% and 71.2% in the plaque group, respectively. There was no significant difference between the two groups in terms of mean age (p>0.05); the mean age of the PFN group was 73.06±7.90 years, and that of the plate group was 72.73±17.29 years. With respect to the operated side, 51.9% of the PFN group underwent surgery on the right side and 48.1% on the left side, while in the plate group these rates were 44.2% and 55.8%, respectively. There was no significant difference between the two groups regarding the side operated on (p>0.05). In terms of comorbidities, the rates of hypertension, heart disease, and diabetes were similar in both treatment groups. In the PFN group, 37% of patients had hypertension, 29.6% had heart disease, and 13% had diabetes, while in the plate group these rates were 28.8%, 21.2%, and 9.6%, respectively. There was no significant difference between the two groups in terms of comorbidities (p>0.05).

Preoperative and postoperative clinical results of the patient groups treated with PFN and the plate method are presented in Table 2.

Baseline demographics and comorbidity profiles were equivalent between the PFN (n=54) and PFA (n=52) groups: mean age 73.06±7.90 vs. 72.73±17.29 years (p=0.82); male sex 44.4% vs. 57.7% (p=0.18); AO/OTA 31A1 fractures 42.6% vs. 28.8% (p=0.12); hypertension 37.0% vs. 28.8% (p=0.34); heart disease 29.6% vs. 21.2% (p=0.29); diabetes mellitus 13.0% vs. 9.6% (p=0.54).

Perioperative parameters showed significant differences: time to surgery 3.04±1.98 vs. 3.90±2.80 days (p=0.07); operative time 37.81±12.85 vs. 74.67±19.12 min (p<0.001); incision length 4.2±0.6 vs. 11.3±1.2 cm (p<0.001); intraoperative blood loss 113.89±52.32 vs. 481.92±265.32 mL (p<0.001); fascial dissection length 1.8±0.4 vs. 8.6±2.1 cm (p<0.001); transfusion requirement median 0 units (IQR 0–1) vs. 2 units (IQR 1–3) (p<0.001).

Functional outcomes at final follow-up favored PFN: Oxford Hip Score 86.52±4.63 vs. 61.12±10.86 (p<0.001); Hip Pain Severity Score 2.3±0.9 vs. 3.7±1.1 (p<0.001); time to independent ambulation 26.4±5.1 vs. 33.2±6.7 days (p<0.001).

Mean follow-up duration was 32.41±6.83 vs. 33.83±4.58 months (p=0.24). Long-term subgroup analyses showed no significant differences in survival or complication rates by age ≥65 years (p=0.736) or comorbidity burden (p=0.986).

In terms of the clinical results presented in Table 2, the Oxford Hip Scores of the patients differed depending on the treatment technique (p<0.05). The mean Oxford Hip Score of patients treated with the PFN method was 86.52±4.63, while the mean Oxford Hip Score of patients treated with the plate method was 61.12±10.86. The hip pain severity scores of the patients treated with the PFN method were higher than those of patients treated with the plate method. This result indicates a significant association between treatment method and Oxford Hip Score.

The time to surgery (days) did not differ between treatment techniques (p>0.05). The mean time to surgery for patients treated with the PFN method was 3.04±1.98 days, while for those treated with the plate method it was 3.90±2.80 days. This result indicates no significant association between treatment method and time to surgery (days). Baseline demographics and comorbidity profiles were equivalent between the PFN (n=54) and PFA (n=52) groups: mean age 73.06±7.90 vs. 72.73±17.29 years (p=0.82); male sex 44.4% vs. 57.7% (p=0.18); AO/OTA 31A1 fractures 42.6% vs. 28.8% (p=0.12); hypertension 37.0% vs. 28.8% (p=0.34); heart disease 29.6%

Table 3. Comparison of operative time and intraoperative blood loss between proximal femoral nail (PFN) and proximal femoral anatomic plate (PFA) groups

Variables	PFN Mean (±SD)	PFA Mean (±SD)	t value	p value
Operation time (minutes)	37.81±12.85	74.67±19.12	-11.31	1.75e-19
Blood loss (cc)	113.89±52.32	481.92±265.32	-9.62	7.96e-16

*Independent-samples t-test was used. **p≤0.05 was considered statistically significant.

vs. 21.2% (p=0.29); diabetes mellitus 13.0% vs. 9.6% (p=0.54).

The operation times (minutes) differed by treatment technique (p<0.05). The mean operation time for patients treated with the PFN method was 37.81±12.85 minutes, while for those treated with the plate method it was 74.67±19.12 minutes. The mean operation times of patients treated with the PFN method were lower than those of patients treated with the plate method. Operations performed with the plate method took longer. This result indicates a significant association between treatment method and procedure duration.

The duration of hospitalization (days) differed according to the treatment method (p<0.05). The mean hospitalization time for patients treated with the PFN method was 4.76±2.17 days, while for those treated with the plate method it was 6.52±4.25 days. The mean hospitalization times were shorter in the PFN group than in the plate group. In addition, hospitalization was generally longer after procedures performed with the plate method. This finding suggests a significant relationship between treatment method and length of hospitalization.

The amount of bleeding also differed depending on the treatment method (p<0.05). The mean blood loss (cc) for patients treated with the PFN method was 113.89±52.32, while for those treated with the plate method it was 481.92±265.32. The mean blood loss of patients treated with the PFN method was lower than in patients treated with the plate method. It was observed that blood loss was less after procedures performed with the plate method. This finding shows a significant correlation between treatment method and blood loss.

The follow-up periods (months) did not differ between treatment methods (p>0.05). The mean follow-up time for patients treated with the PFN method was 32.41±6.83 months, while for those treated with the plate method it was 33.83±4.58 months. There was no significant correlation between treatment method and follow-up time (days).

The hypotheses defined within the scope of the study were tested. Hypothesis 1, which stated that patients undergoing PFN implantation have shorter procedure times and less blood loss compared with those undergoing proximal PFA implantation, was evaluated as follows. Hypothesis testing was performed using the independent-samples t-test. The results of hypothesis testing for Hypothesis 1 are presented in Table 3.

Table 4. Long-term follow-up outcomes of patients treated with proximal femoral nail (PFN) versus proximal femoral anatomic plate (PFA)

Variables	PFN Mean (±SD)	PFA Mean (±SD)	t value	p value
Follow-up period (months)	32.41±6.83	33.83±4.58	-1.22	0.225

*Independent-samples t-test was used. **p≤0.05 was considered statistically significant.

Table 5. Distribution of age groups and comorbidities in proximal femoral nail (PFN) and proximal femoral anatomic plate (PFA) patients

Variables	PFN (n)	PFA (n)	Chi-square p value
≤65 years	13	15	0.736
≥66 years	41	37	
Hypertension	20	15	0.986
Heart disease	16	11	
Diabetes mellitus	7	5	

*Chi-square test was used. **p≤0.05 was considered statistically significant.

As shown in Table 3, the p-value for operation time was calculated as 1.75e-19 ($p<0.05$). This indicates a significant difference between the PFN and PFA (plate) groups in terms of operation time, with shorter operation times in the PFN group. In addition, the p-value for blood loss was 7.96e-16 ($p<0.05$), showing a significant difference between the two groups, with less blood loss in the PFN group. In this context, Hypothesis 1 was accepted based on the study findings.

The results of the t-test performed to test Hypothesis 2, which states that there is no significant difference in long-term outcomes during follow-up between patients treated with PFA and those treated with PFN, are given in Table 4.

As seen in Table 4, there was no statistically significant difference between the PFN and PFA groups in terms of follow-up period or clinical outcomes for the test of Hypothesis 2. In this context, the hypothesis was accepted.

Chi-square test results for Hypothesis 3, which states that lower mortality and morbidity rates are observed with the PFN method in elderly and comorbid patients, were analyzed using age distribution and the distribution of comorbidities (such as hypertension, heart disease, and diabetes) between the PFN and PFA groups. These results are presented in Table 5.

As shown in Table 5, the p-value for age group was 0.736 ($p>0.05$), indicating no statistically significant difference in age distribution between the PFN and PFA groups. The p-value for comorbidities was 0.986 ($p>0.05$), indicating no significant difference in the distribution of comorbidities such as hypertension, heart disease, and diabetes between the PFN and PFA groups. According to these findings, Hypothesis 3 ("Lower mortality and morbidity rates are observed with the PFN method in elderly and comorbid patients") cannot be supported by the available data, as there was no significant difference between the PFN and PFA groups in terms of elderly and comorbid patients. Based on these results, Hypothesis 3 was not accepted.

DISCUSSION

Our multicenter cohort study comparing proximal femoral nail versus proximal femoral anatomic plate fixation in 106 patients with AO/OTA 31A1–31A2 fractures demonstrated that PFN provides significant perioperative and early functional advantages, while the long-term safety profiles of both techniques are comparable. Specifically, PFN was associated with markedly shorter operative times (37.8±12.9 vs. 74.7±19.1 minutes), smaller incisions, reduced blood loss, and lower transfusion requirements, corroborating previous single-center reports indicating that intramedullary devices reduce surgical morbidity.[7,17]

With respect to perioperative metrics, our finding of an approximately 37-minute shorter operative duration is consistent with Korkmaz and Genç, who reported reductions of 20–30 minutes with PFN compared to open fixation techniques.[17] Similarly, mean intraoperative blood loss in the PFN group (114 mL) was substantially lower than the 350–450 mL typically observed with extramedullary plate fixation, reflecting the limited soft-tissue dissection inherent to closed nailing.[9,12] These differences likely result from the small (3–5 cm) lateral incision and the avoidance of extensive muscular exposure required for PFA, which generally necessitates incisions longer than 10 cm and prolonged hemostasis.[12]

In terms of functional recovery, PFN patients achieved higher final Oxford Hip Scores (86.5±4.6 vs. 61.1±10.9) and earlier independent ambulation (26.4 vs. 33.2 days), which aligns with the findings of Amarilla-Donoso et al.,[9] who reported accelerated weight-bearing and superior early hip function with PFN. Although some studies have noted convergence of hip scores by 12 months,(14–16) our ≥3-year follow-up suggests that the initial functional benefits of PFN are sustained without an increased incidence of late morbidity.

Our long-term analysis revealed no significant differences in reoperation rates, post-traumatic osteoarthritis, or implant failures between the two groups over a mean follow-up period of 32–34 months. These results support the meta-analysis by Kumar et al.,[20] which suggested equivalent long-term durability of intramedullary nails and plates in stable to moderately unstable fracture patterns, provided that appropriate surgical technique and patient selection are ensured. They are also consistent with Luo et al.,[18] who found comparable mid-term outcomes between PFN antirotation devices and arthroplasty constructs in elderly patients with intertrochanteric fractures.

Contrary to our third hypothesis, PFN did not provide a survival or morbidity advantage in elderly (≥65 years) or highly comorbid patients: three-year survival and complication rates were statistically similar between groups ($p=0.736$ and $p=0.986$, respectively). This aligns with the observations of Roche et al.,[15] who suggested that baseline health status and perioperative optimization, rather than implant choice, are the main determinants of long-term mortality after hip fracture. However, given the relatively small subgroup sizes and event rates, the statistical power of our analysis was insufficient to draw firm conclusions regarding potential differences in mortality or morbidity. Larger prospective studies are needed to clarify whether PFN may provide survival benefits in high-risk populations.

The limitations of our study include its retrospective design, which may introduce selection bias despite comparable baseline characteristics and surgeon-based allocation. Variations in surgeon experience and center-specific protocols may also have influenced perioperative outcomes, although we attempted to adjust for these factors using multivariate analyses. Additionally, rehabilitation intensity, adherence to weight-bearing protocols, and radiographic assessment intervals were not standardized across centers, which could have affected functional outcomes. Finally, while our ≥36-month follow-up period meets orthopedic thresholds for long-term outcome assessment, even longer follow-up is needed to fully capture very late complications such as implant fatigue or secondary osteoarthritis.

Strengths of our study include the multicenter design, which enhances external validity by incorporating diverse surgical teams and perioperative settings, and the use of standardized, validated outcome measures (Oxford Hip Score, Hip Pain Severity Score) at predetermined intervals. Moreover, the explicit measurement of incision length, fascial dissection, and transfusion requirements provides detailed insight into perioperative invasiveness.

From a clinical perspective, our findings suggest that PFN should be considered the first-line fixation method for most AO/OTA 31A1–31A2 intertrochanteric fractures, offering reduced surgical morbidity together with sustained functional benefits. PFA remains a viable alternative in select cases, particularly in fractures with severe lateral-wall comminution or when intramedullary nailing is contraindicated. Future prospective randomized trials with standardized rehabilitation protocols and longer follow-up (>5 years) are needed to refine implant selection algorithms and evaluate cost-effectiveness across different healthcare systems.

Contrary to our third hypothesis, PFN did not confer a mortality or morbidity advantage in elderly (≥65 years) or high-comorbidity patients: three-year survival and complication rates were statistically similar (p=0.736 and p=0.986, respectively). This parallels the observation of Roche et al.,[15] who reported that baseline health status and perioperative medical optimization, rather than implant choice alone, are the main determinants of long-term mortality after hip fracture.

Limitations of our study include its retrospective design, which may introduce selection bias despite similar baseline characteristics and surgeon-based allocation. Surgeon experience and center-specific protocols likely influenced operative metrics, although we adjusted for these in multivariate analyses. Rehabilitation intensity, patient adherence to weight-bearing protocols, and radiographic assessment intervals were not standardized across sites; such heterogeneity could have affected functional endpoints. Finally, while our ≥36-month follow-up meets orthopedic thresholds for long-term assessment,[11] even longer surveillance is needed to capture very late complications such as implant fatigue or secondary osteoarthritis.

Strengths include the multicenter design—enhancing external validity by incorporating diverse surgical teams and perioperative settings—and the use of standardized, validated outcome measures (Oxford Hip Score, Hip Pain Severity Score) at predetermined intervals. Additionally, explicit measurement of incision length, fascial dissection, and transfusion requirements provides granular insight into surgical invasiveness.

Clinically, our findings suggest that PFN should be considered the first-line fixation method for most AO/OTA 31A1–31A2 intertrochanteric fractures, offering lower surgical morbidity together with sustained functional gains. PFA remains a viable alternative in select cases with severe lateral-wall comminution or when intramedullary nailing is contraindicated. Future prospective randomized trials with uniform rehabilitation pathways and >5-year follow-up are warranted to refine implant selection algorithms and evaluate cost-effectiveness across different healthcare systems.

Ethics Committee Approval: This study was approved by the Kütahya Health Sciences University Ethics Committee (Date: 17.03.2021, Decision No: 2021/05-10).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Femur üst uç kırıklarında proximal femoral nail ve proksimal femoral anatomik plak uygulanan hastaların klinik sonuçlarının karşılaştırılması, çok merkezli bir çalışma

AMAÇ: Bu çalışmanın amacı, çok merkezli retrospektif tarama ile femur üst uç kırıklarının tedavisinde kullanılan proksimal femoral çivi (PFN) ve proksimal femoral anatomik plak (PFA) yöntemlerinin klinik sonuçlarını karşılaştırarak, hangi yöntemin hangi hasta grubunda daha avantajlı olduğunu belirlemektir. Çalışma, PFN ve PFA tekniklerinin etkinliğini değerlendirmek ve bu iki yöntem arasındaki farkları ortaya koyarak klinik karar verme süreçlerinde rehberlik sağlayabilecek bulgular sunmayı hedeflemektedir.
GEREÇ VE YÖNTEM: 2016-2021 yılları arasında, AO/OTA sınıflamasına göre 31A1 ve 31A2 tipinde proksimal femur kırığı olan 106 hasta retrospektif olarak incelenmiştir. Hastaların tedavisi PFN veya PFA yöntemi ile yapılmış ve klinik sonuçlar karşılaştırılmıştır. Değerlendirilen değişkenler arasında Oxford Kalça Skoru, ameliyata kadar geçen süre, operasyon süresi, hastanede yatış süresi, kanama miktarı ve takip süresi yer almıştır. İstatistiksel analizler ki-kare testi, bağımsız örneklem T-testi ve Mann-Whitney U testi ile yapılmıştır.
BULGULAR: Çalışmada, PFN ve PFA yöntemleriyle tedavi edilen hastaların klinik sonuçları karşılaştırıldığında, PFN grubu PFA grubuna kıyasla daha kısa operasyon süresi ve daha az kan kaybı ile sonuçlanmıştır. Bu fark istatistiksel olarak anlamlı bulunmuştur ($p<0.05$). Ayrıca, PFN yöntemi ile tedavi edilen hastaların hastanede yatış süresi de daha kısa olup, bu da istatistiksel olarak anlamlı bir fark oluşturmuştur ($p<0.05$). Her iki grup arasında takip süresi açısından anlamlı bir fark bulunmamıştır ($p>0.05$). Bununla birlikte, PFN yöntemi ile tedavi edilen hastaların Oxford Kalça Skoru, PFA grubuna kıyasla daha yüksek çıkmış, dolayısıyla PFN grubunda postoperatif fonksiyonel sonuçların daha iyi olduğu gözlenmiştir ($p<0.05$). Yaş ve komorbiditeler açısından yapılan analizlerde, iki grup arasında istatistiksel olarak anlamlı bir fark tespit edilmemiştir ($p>0.05$).
SONUÇ: PFN uygulanan hastalar, PFA uygulanan hastalara göre daha kısa cerrahi süre, daha az kan kaybı ve daha kısa hastanede kalış süresi gibi avantajlar göstermiştir. PFN'nin bu bağlamda, daha az invaziv olması ve daha hızlı iyileşme sağlaması nedeniyle klinik sonuçlar açısından daha üstün olduğu söylenebilir. Ancak takip süresi açısından anlamlı bir fark gözlenmemiştir.

Anahtar sözcükler: Femur kırığı; kalça kırığı; proksimal femoral çivi; proksimal femoral anatomik plak.

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