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Clinical Evaluation of Patients with Pertrochanteric Fractures Treated with Gamma Nail in 5th Azar Educational and Therapeutic Center

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Abstract

Background and Objectives: Due to the high incidence of intertrochanteric fractures in the elderly, their significant morbidity, and the lack of consensus regarding the optimal treatment method, we decided to evaluate the clinical status of patients treated with gamma nail fixation.

Methods: In this cross sectional study, out of 67 patients with pertrochanteric fractures treated with a gamma nail between 2018 and 2020, about 43 cases were included. Patients were followed monthly until callus formation was observed on radiographs. At the final follow-up, the Harris Hip Score (HHS) was determined, and radiographic and clinical outcomes were assessed according to the AO classification.

Results: The mean age of the patients was 60.7 ± 21 years, and the mean time to union was 15.1 ± 8.9 weeks. The mean HHS was 76.1 ± 24, of which 12 patients (28.1%) had excellent, 19 patients (44.1%) good, 2 patients (4.6%) fair, and 10 patients (23.2%) poor results. There was no significant difference in HHS among different AO fracture types (A1, A2, A3) (P = 0.16). The mean pain score in the HHS was 35.5 ± 10.69. No significant difference in pain score was found among the A1, A2, and A3 groups (P = 0.25). The mean HHS for fractures near the base of the femoral neck was 67.33, for intertrochanteric fractures 81.81, and for intertrochanteric–subtrochanteric fractures 63.5.

Conclusion: The use of gamma nail is an effective treatment method for pertrochanteric fractures, resulting in good to excellent clinical and functional outcomes (based on HHS) in more than 70% of cases.

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Introduction

Trochanteric fractures particularly pertrochanteric and intertrochanteric fractures are among the most common fractures in the elderly population (1). Because of the substantial mortality, disability, prolonged hospitalization, and high healthcare costs associated with these injuries, choosing an appropriate treatment strategy is crucial (2). Recent studies indicate that the method of internal fixation plays a direct role in functional outcomes, hospital stay, and postoperative complications (3).

Over the past decades, intramedullary fixation devices such as the Proximal Femoral Nail (PFN) and, in particular, the Gamma nail, have gained popularity as the preferred treatment for pertrochanteric femoral fractures. These implants provide greater biomechanical stability and enable early weight-bearing and faster rehabilitation (4).

Recent evidence suggests that intramedullary implants including the Gamma nail offer advantages over extramedullary devices such as the Dynamic Hip Screw (DHS), including shorter operative time, reduced

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blood loss, and shorter hospital stay. For example, a clinical study on patients with unstable trochanteric fractures reported that use of the Gamma nail was associated with lower reoperation rates and fewer postoperative complications compared with DHS (5,6).

However, long-term outcomes and implant-related complications remain a concern. Meta analyses have shown that despite similar overall union rates and survival, certain implant types including third-generation intramedullary nails may be more susceptible to complications such as cut-out, implant failure, or screw migration (7). Epidemiologic studies have also demonstrated no significant difference in one-year mortality or functional independence between patients requiring reoperation after intramedullary fixation and those who did not, suggesting that reoperation does not necessarily lead to markedly poorer survival outcomes (8).

Moreover, patient-related factors such as cardiovascular comorbidities, hypertension, or anticoagulant use play an important role in postoperative complications. A large cohort study (n ≈ 7979) showed that despite advancements in nail design, implant type (e.g., Gamma3 versus TFNA) did not significantly affect the risk of major complications leading to reoperation. Instead, patient-related risk factors such as heart failure, hypertension, and anticoagulant therapy were strongly associated with complication rates (9).

Additionally, implant positioning such as screw placement, tip apex distance, and the quality of fracture reduction is recognized as a key determinant of survival and treatment success. A recent study on PFN-treated patients demonstrated that variables including bone mineral density (T-score), fracture classification, radiographic quality of reduction, and implant positioning were strongly associated with clinical outcomes (10).

Despite improvements in intramedullary nail designs, it remains unclear whether the Gamma nail offers a significant advantage over other fixation methods in high-risk populations such as osteoporotic elderly patients. Predictive factors of postoperative complications also remain insufficiently defined, and the influence of reduction quality and implant positioning on treatment failure requires further clarification. These uncertainties highlight the need for additional research to accurately determine the performance of Gamma nail fixation.

Therefore, the present study was designed to evaluate the clinical outcomes, complications, and predictive factors in patients with pertrochanteric femoral fractures treated with Gamma nail fixation. The findings of this study may contribute to improving clinical decision-making, optimizing implant selection, and enhancing surgical techniques.

Methods

This descriptive cross-sectional study was conducted after obtaining approval from the Ethics Committee of Golestan University of Medical Sciences (IR.GOUMS.REC.1396.96). Medical records of 67 patients with pertrochanteric femoral fractures including basicervical, intertrochanteric, and intertrochanteric fractures extending into the subtrochanteric region who underwent Gamma nail fixation at 5th Azar Hospital in Gorgan were reviewed.

Of these, 24 patients were excluded due to incomplete clinical or radiographic information, death during follow-up, or the presence of multiple traumatic injuries. Ultimately, 43 patients were included in the analysis. No cases of open or pathological fractures were observed. Patients were followed monthly until callus formation was evident on radiographs or until pain-free weight-bearing was achieved.

At the final follow-up, functional outcomes were assessed using the Harris Hip Score (HHS), categorized as poor (<70), fair (70–80), good (80–90), and excellent (90–100). The HHS ranges from 0 to 100, with higher scores indicating better hip function; 44 points are allocated to pain and 56 points to function. Radiological and clinical evaluations were performed according to the AO classification, with A1 fractures considered stable and A2–A3 fractures considered unstable.

Data analysis was performed using SPSS version 16. Quantitative variables were reported as mean and standard deviation, and qualitative variables as frequency and percentage. The Chi-square and Mann–Whitney tests were used to analyze associations between qualitative variables, whereas ANOVA was applied for quantitative comparisons. A P-value < 0.05 was considered statistically significant.

All patients were placed under skin traction until imaging and laboratory evaluations were completed. During hospitalization, a single dose of vitamin D was administered. Prophylactic antibiotics were given prior to surgery. Patients were positioned on an orthopedic table, and fracture reduction was confirmed in two planes using C-arm fluoroscopy. Through a trochanteric entry point, after proximal and distal reaming, a Gamma nail was inserted.

Implants (manufactured by Kosar Company) had diameters of 9–12 mm, lengths of 18–42 cm, and medical device registration code 16078. The lag screw was placed in the central or inferior position of the femoral head and neck. Postoperatively, antibiotics were continued for 48 hours. Ankle, knee, and hip exercises were initiated on the first postoperative day, and patients were discharged with anticoagulants and

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instructions for partial weight-bearing with a walker. Full weight-bearing was withheld until radiographic evidence of callus formation.

Results

Among the 43 patients included in the study27 men and 16 women—the mean age was 60.7 ± 21 years. The mechanism of injury was motor vehicle accidents in 55% of cases, with a mean age of 59.7 years, while the remaining patients sustained fractures following a fall from standing height, with a mean age of 61.8 years. The mean duration of hospitalization was 11 days, and the mean time to union was 15.1 ± 8 weeks. Based on the AO classification, 44.1% of fractures were stable (A1) and 55.9% were unstable (A2, A3). Short Gamma nails were used in 88.3% of patients (mean age 65 years), while long Gamma nails were used in 11.6% of patients (mean age 40 years).

The mean Harris Hip Score (HHS) was 76.1 ± 24.9. Twelve patients (28.1%) had excellent outcomes, 19 patients (44.1%) good, 2 patients (4.6%) fair, and 10 patients (23.2%) poor (Table 1). The mean HHS for A2.2 fractures was 96.5, which was higher than that of other fracture types. No statistically significant difference was found between HHS scores among AO groups A1, A2, and A3 (P = 0.16). Subtrochanteric extension was present in approximately 13.9% of cases. The mean HHS was 67.33 for basicervical fractures, 81.81 for intertrochanteric fractures, and 63.5 for intertrochanteric–subtrochanteric fractures.

Table 1. HHS scores in patients based on AO fracture classification

AO Classification	Number of Cases	Poor (%)	Fair (%)	Good (%)	Excellent (%)	Mean HHS	Mean Pain Score (HHS)
A1.1	10	20	20	20	40	73.2	30.8
A1.2	9	44.5	0	55.5	0	73	37.5
A2.1	2	0	0	0	100	93	44
A2.2	4	0	0	0	100	96.5	44
A2.3	5	0	0	100	0	86	40
A3.1	2	0	0	0	100	89	44
A3.2	4	0	0	100	0	92	40
A3.3	7	57.1	0	42.8	0	44.3	23.3

The mean HHS pain score was 35.5 ± 10.69. No significant difference in pain scores was found among AO groups A1, A2, and A3 (P = 0.25). The mean HHS in patients treated with long Gamma nails was 72.25 ± 25.26, whereas it was 77.06 ± 25.65 in those treated with short Gamma nails. The mean HHS pain score was 35.5 ± 9.57 in the long-nail group and 36.25 ± 11.12 in the short-nail group. There was no statistically significant association between HHS scores and the use of long versus short Gamma nails (P = 0.44).

No cases of infection or nail breakage were observed. One patient developed symptomatic deep vein thrombosis, which was treated appropriately; this patient had delayed presentation and surgical intervention due to medical issues. Three patients developed heterotopic ossification around the proximal end cap, of which only one was clinically symptomatic. Five patients developed femoral neck shortening and varus malunion; among them, one experienced lateral hip pain owing to lag screw prominence. Two cases of superior cut-out of the lag screw were noted, both of which resulted in nonunion. These patients refused further surgery; both were older than 75 years and had osteoporosis.

There was no significant difference in the frequency of radiologic complications between patients operated in the first half of the study period and those in the second half (P > 0.05).

Discussion

In this study, the clinical and radiographic outcomes of patients with pertrochanteric femoral fractures treated with Gamma nail were evaluated. Our findings indicate that the use of Gamma nail in this population can provide acceptable functional outcomes, with rates of major complications such as reoperation or mechanical failures comparable to those reported in the literature.

Recent meta-analyses also confirm the important role of intramedullary implants, including PFN and Gamma nails, in postoperative rehabilitation. A recent systematic review and meta-analysis demonstrated that intramedullary nailing, compared to DHS, is associated with better functional outcomes, improved postoperative quality of life, and higher patient survival (11).

Other meta-analyses focusing on unstable fractures have shown that PFN can achieve union rates similar to DHS while resulting in fewer or more acceptable complications, such as reoperation or infection (12). Practical studies support these findings. For example, Mousa et al. (2025) in BMC Musculoskeletal Disorders

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performed a systematic comparison between DHS and PFN for stable fractures and reported no significant differences in survival or clinical function, although benefits such as shorter hospital stay and fewer postoperative complications were observed in the PFN group (13). Similarly, a 2024 study by Ansari in India compared PFN and DHS for intertrochanteric fractures and found that while long-term functional outcomes were not significantly different, early results (1–6 months) favored PFN (14).

In a randomized study involving 146 intertrochanteric fractures, although both methods were effective, major fracture-related complications were twice as common in the Gamma nail group compared to DHS, suggesting that TGN (Gamma) may offer advantages in selected fracture types (15). Another meta-analysis reported that PFN (including Gamma nails) significantly reduced surgical site infections compared to DHS (16).

Romeh et al. (2023) evaluated stable fractures and found no significant differences in functional or radiographic outcomes between Gamma nail and DHS, although the DHS group experienced higher intraoperative blood loss (17). Overall, careful clinical follow-up plays a critical role in improving care quality and promoting patient health (18,19). Based on our findings, clinical research can significantly contribute to enhancing and strengthening patient care (20,21).

Conclusion

Gamma nail provides acceptable clinical and radiographic outcomes in the treatment of pertrochanteric femoral fractures and improves patient function. The rates of major complications, such as reoperation and mechanical failures, are comparable to previously reported studies. Advantages of Gamma nail include high biomechanical stability, early weight-bearing, and faster functional recovery. In both stable and unstable fractures, there is generally no significant difference in clinical outcomes between Gamma nail and DHS, although benefits such as reduced hospital stay and fewer early complications have been observed. Regular clinical follow-up and attention to reduction quality and implant positioning play a critical role in minimizing complications and enhancing outcomes. These findings may guide the selection of appropriate internal fixation methods and improve surgical techniques in patients with pertrochanteric fractures.

Limitations

This study was limited to the patient population of a single teaching hospital, which restricts the generalizability of the results. The relatively small sample size may reduce the statistical power for analyzing some variables. Another limitation is the lack of long-term evaluation of functional outcomes and postoperative quality of life. Additionally, potential variations in surgical technique and surgeon experience may have influenced the results.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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