



Efficacy and Outcomes of Gamma Nail Versus Proximal Femoral Nail in the Treatment of Stable Extracapsular Fractures of the Proximal Femur: A Comparative Study

Dr. Akshay Sharma¹, Dr. Anu Kumar Changkum², Dr Ashish Meena³,
Dr. Vipin Sharma⁴

¹MS Orthopaedics, Dr. RPGMC Kangra at Tanda.

²MS Orthopaedics, Dr. RPGMC Kangra at Tanda.

³MS Orthopaedics, Dr RPGMC Kangra at Tanda.

⁴Professor and Head, Department of Orthopaedics, Dr. RPGMC Kangra at Tanda.

Article Info: Received: 04-01-2024 / Revised: 18-02-2024 / Accepted: 20-03-2024

Address for correspondence: Dr Ashish Meena

DOI: <https://doi.org/10.32553/jbpr.v13i2.1080>

Conflict of interest statement: No conflict of interest

Abstract:

Background: Stable extracapsular fractures of the proximal femur are a common and challenging injury in the elderly, with Gamma Nail and Proximal Femoral Nail (PFN) being the primary surgical options. This study aims to compare the efficacy and outcomes of these two methods.

Methods: A prospective study was conducted on 50 patients with stable extracapsular fractures, randomly assigned to undergo CRIF with either Gamma Nail or PFN. Parameters such as operation time, blood loss, radiological outcomes, and postoperative recovery were analyzed.

Results: The Gamma Nail group experienced shorter operation times (33 ± 6.5 min) and less blood loss (28.08 ± 32.80 ml) compared to the PFN group. Radiological outcomes showed no significant difference between the groups, with high success rates in achieving stable fixation. Both methods demonstrated effectiveness in managing these fractures, but Gamma Nail offered some technical advantages.

Conclusion: Gamma Nail and PFN are both effective for treating stable extracapsular fractures of the proximal femur, with the choice of technique depending on various patient-specific factors.

Keywords: Extracapsular fractures, proximal femur, Gamma Nail, Proximal Femoral Nail, orthopedic surgery, elderly.

Introduction

The management of stable extracapsular fractures of the proximal femur represents a significant challenge and an important area of orthopedic surgery, given the rising prevalence of such injuries among the elderly due to osteoporosis and increased risk of falls.¹ This patient population often presents with various

comorbidities, complicating the choice of surgical intervention and postoperative care. Among the available surgical options, Closed Reduction and Internal Fixation (CRIF) with either Gamma Nail or Proximal Femoral Nail (PFN) has emerged as the standard treatment modalities, each with its unique advantages and

considerations. This comparative study aims to evaluate the clinico-radiological outcomes of these two surgical techniques, providing evidence-based insights that could guide clinical decision-making and improve patient care.²

Fractures of the proximal femur, particularly intertrochanteric fractures, account for a significant portion of orthopedic hospital admissions among older adults, often resulting from low-energy trauma. These injuries not only represent an acute medical and surgical challenge but also have profound implications for the patient's mobility, independence, and quality of life.³ The choice between Gamma Nail and PFN is influenced by various factors, including fracture pattern, patient anatomy, surgeon preference, and institutional experience. Despite the widespread use of both techniques, there remains ongoing debate within the orthopedic community regarding their relative efficacy, complication rates, and impact on postoperative recovery and long-term function.⁴

The Gamma Nail, introduced in the late 1980s, was designed to provide stable fixation for pertrochanteric fractures, with the theoretical advantages of minimally invasive insertion, reduced blood loss, and early mobilization. On the other hand, the PFN, developed to address some limitations observed with the Gamma Nail, offers an alternative with potential benefits in terms of biomechanical stability and versatility in managing a wider range of fracture types. However, both systems have been associated with specific complications, and the literature presents mixed outcomes regarding their performance and patient recovery trajectories.⁵

This study enrolled 50 patients with stable extracapsular fractures of the proximal femur, randomly assigned to undergo CRIF with either Gamma Nail or PFN. We conducted a comprehensive clinico-radiological evaluation of the two groups, focusing on parameters such as operation time, blood loss, time from injury to surgery, hospital stay duration, postoperative mobility, and radiological union. Through a meticulous analysis of these outcomes, we

sought to contribute to the ongoing discourse on optimizing surgical care for this vulnerable patient population.⁶

Our findings aim to shed light on several critical aspects of proximal femur fracture management, including the efficiency and safety of the surgical techniques, the influence of patient demographics and injury patterns on surgical outcomes, and the implications for postoperative recovery and rehabilitation. By providing a detailed comparison of the Gamma Nail and PFN in the context of stable extracapsular fractures, this study offers valuable insights that could influence clinical practices, guide future research, and ultimately enhance the care and prognosis of patients suffering from these common yet complex injuries.

Materials and Methods

Study Area

The research was carried out in the Department of Orthopedics at Dr. R.P.G.M.C. Kangra, located in Tanda, Himachal Pradesh. This setting provided a comprehensive environment for the prospective study, ensuring access to a relevant patient population and facilitating rigorous data collection and analysis.

Study Design

This investigation was structured as an open cohort, prospective study, designed to systematically collect and analyze data from a specifically targeted patient group over a predetermined period. This design allowed for a dynamic entrance and exit of study participants while maintaining the integrity of the study's objectives.

Study Population

The study population comprised patients seeking treatment at the Department of Orthopaedics, who underwent surgical intervention using either the Gamma Nail or the double screw PFN technique for treating extracapsular femoral fractures. This selection criteria ensured that the study focused on a homogenous group affected by similar orthopedic conditions.

Study Duration

Patient recruitment spanned one year, with all eligible participants who presented during this timeframe and met the inclusion criteria being enrolled in the study. This period was sufficient to gather a representative sample of patients while also allowing for an in-depth follow-up of each case.

Sample Size

Fifty consecutive patients who presented with stable intertrochanteric fractures and met the inclusion criteria were enrolled. This sample size was deemed appropriate for achieving statistical significance while allowing for comprehensive individual follow-ups.

Inclusion Criteria

- Patients undergoing surgery for stable extracapsular proximal femur fractures classified under AO 31A1.1, 31A1.2, and 31A1.3.
- Patients who consented to participate in the study.

Exclusion Criteria

- Patients with pre-operative comorbidity in the fractured hip.
- Patients suffering from fracture neck femur, hip fractures with dislocation, ipsilateral fracture shaft of femur, unstable intertrochanteric fractures (AO 31A2 and AO 31A3), and open hip fractures.
- Patients who declined to participate in the study.

Ethical Justification

The Institutional Ethics Committee of Dr. RPGMC Kangra at Tanda granted approval for this study. All participants were informed of their right to withdraw from the study at any point without affecting their treatment.

Preoperative Protocol

The protocol included comprehensive patient assessment, classification of fractures according to the AO classification, and preoperative

preparations tailored to optimize patients for surgery. Detailed information about the surgery, expected outcomes, and potential complications was provided to each patient.

Operative Steps

The surgical approach was standardized for all patients, emphasizing minimally invasive techniques, precise implant placement, and postoperative care aimed at promoting early mobility and minimizing complications. Specific steps of the operation were meticulously followed to ensure consistency across all procedures.

Post-Operative Rehabilitation

A structured rehabilitation program was initiated immediately post-surgery, focusing on early mobilization, pain management, and gradual return to full function. Follow-up assessments were scheduled at specified intervals to monitor recovery progress and adjust care plans as needed.

Follow UP

Regular follow-up visits were scheduled for up to one year and six months for the first case, with subsequent cases followed for a minimum of six months. These visits included clinical and radiological assessments to evaluate healing progress, complication management, and recovery of mobility and independence.

Outcome Assessment

Outcomes were assessed using validated scales for mobility, pain, and social dependency, comparing results between the two surgical groups to determine the efficacy of each technique in facilitating patient recovery and return to normalcy.

Statistical Analysis

Data analysis was conducted using SPSS version 22, employing the Kolmogorov-Smirnov test for normality checks. Quantitative data was presented as means \pm standard deviation, and qualitative data as frequencies and proportions. Comparative analysis was performed using the

unpaired t-test, with a p-value of less than 0.05 considered statistically significant.

Results

The results of our study provide a comprehensive comparison between the surgical efficacy, radiological outcomes, and blood loss associated with Closed Reduction and Internal Fixation (CRIF) using Gamma Nail versus Proximal Femoral Nail (PFN) in the treatment of stable extracapsular fractures of the proximal femur.

Surgical Efficacy: The average operation time for the Gamma Nail group was significantly shorter at 33±6.5 minutes compared to 61±10.3 minutes for the PFN group, indicating a more efficient surgical process with the Gamma Nail. Blood loss during surgery was quantitatively lower in the Gamma Nail group, with an average of 28.08±32.80 ml, as opposed to the PFN group where the blood loss was significantly greater, although the exact quantity is not specified. Both groups showed comparable times from injury to surgery and hospital stay durations, with averages of 10.31±13.05 days and 9.65±3.07 days, respectively.

Radiological Outcomes and Time to Union: Radiological assessment revealed that 92% of

patients in both the Gamma Nail and PFN groups achieved union within 11-14 weeks. There were no cases of malunion or loss of reduction observed in either group, demonstrating the effectiveness of both surgical techniques in achieving satisfactory radiological outcomes.

Distribution of Patients by Surgery Type: The study equally distributed the sample, with 25 patients (50%) undergoing surgery with the Gamma Nail and 25 patients (50%) with the PFN. This equal distribution allows for a balanced comparison between the two surgical techniques.

Intraoperative Blood Loss Comparison: A detailed analysis of intraoperative blood loss revealed that a greater percentage of patients in the Gamma Nail group experienced lower volumes of blood loss compared to the PFN group. Specifically, blood loss less than 30 ml was observed in a significantly larger portion of the Gamma Nail group. In contrast, higher volumes of blood loss (40-60 ml) were more prevalent in the PFN group, indicating a trend towards increased blood loss with the PFN technique.

Table 1: Comparative Analysis of Surgical Efficacy

Variable	CRIF with Gamma Nail	CRIF with PFN
Operation time (min)	33±6.5	61±10.3
Blood loss during surgery (ml)	28.08±32.80	Significantly greater
Time from injury to surgery (days)	10.31±13.05	Comparable
Hospital stay duration (days)	9.65±3.07	Comparable

Table 2: Radiological Outcomes and Time to Union

Variable	CRIF with Gamma Nail	CRIF with PFN
Weeks to radiological union	11-14 weeks (92%)	11-14 weeks (92%)
Cases of malunion	0	0
Cases of loss of reduction	0	0

Table 3: Distribution of Patients by Surgery Type

Surgery Type	Number of Cases	Percentage
CRIF with Gamma Nail	25	50%
CRIF with PFN	25	50%

Table 4: Intraoperative Blood Loss Comparison

Blood loss during surgery (ml)	CRIF with Gamma Nail (%)	CRIF with PFN (%)
10-20	4.2	0
15-20	29.2	0
18-20	4.2	0
20-25	4.2	0
20-30	33.4	0
30-35	12.5	0
30-40	4.2	20
40-50	8.3	28
50-60	0	36
60-70	0	12
80-90	0	4

Discussion

This comparative study between Gamma Nail and Proximal Femoral Nail (PFN) for the treatment of stable extracapsular fractures of the proximal femur revealed significant insights into their efficacy, surgical outcomes, and impact on postoperative recovery.⁷ The findings contribute to the ongoing debate on the optimal surgical intervention for these fractures, especially among the elderly with various comorbidities.⁸

The shorter operation time and lower blood loss observed in the Gamma Nail group underscore the technical efficiency and potentially lower surgical risk associated with this method.⁹ These aspects are crucial in managing elderly patients, where minimizing time under anesthesia and reducing intraoperative blood loss are significant concerns due to their fragile health status and higher susceptibility to complications.¹⁰

Radiological outcomes demonstrated high success rates for both techniques, with no cases of malunion or loss of reduction, highlighting the adequacy of both Gamma Nail and PFN in achieving stable fixation.¹¹ The equal distribution of patients by surgery type and the comparative analysis of intraoperative blood loss further reinforce the validity of the results, showcasing a direct comparison under similar conditions.¹²

Despite these advancements, the study acknowledges the inherent limitations

associated with each technique, such as the potential for specific complications and the influence of surgeon experience and preference. The choice between Gamma Nail and PFN should be tailored to individual patient profiles, considering factors such as bone quality, fracture pattern, and overall health status.

Conclusion

Both Gamma Nail and PFN are effective for treating stable extracapsular fractures of the proximal femur, with the Gamma Nail showing advantages in terms of shorter operation times and reduced blood loss. However, the choice of surgical intervention should be based on a comprehensive assessment of patient-specific factors. Future research should explore long-term functional outcomes and quality of life post-surgery to further guide clinical decision-making.

References

1. Ju DG, Rajae SS, Mirocha J, Lin CA, Moon CN. Nationwide Analysis of Femoral Neck Fractures in Elderly Patients: A Receding Tide. *Journal of Bone Joint Surgery American Volume*. 2017;99(22):1932-1940.
2. Pedersen AB, Ehrenstein V, Szépligeti SK, Lunde A, Lagerros YT, Westerlund A, et al. Thirty-five-year Trends in First-time Hospitalization for Hip Fracture, 1-year Mortality, and the Prognostic Impact of Comorbidity: A Danish Nationwide Cohort

- Study, 1980-2014. *Epidemiology*. 2017;28(6):898-905.
3. Fox KM, Magazines J, Hebel JR, et al. Intertrochanteric vs femoral neck fractures: differential characteristics, treatment, and sequelae. *Journal of Gerontology A Biological Sciences and Medical Sciences*. 1999;54:635-640.
 4. Bhandari M, Schemitsch E, Jonsson A, Zlowodzki M, Haidukewych GJ. Gamma nails revisited: Gamma nails versus compression hip screws in the management of intertrochanteric fractures of the hip: a meta-analysis. *Journal of Orthopaedic Trauma*. 2009;23(6).
 5. Ma KL, Wang X, Luan FJ, Xu HT, Fang Y, Min J, et al. Proximal femoral nails antirotation, Gamma nails, and dynamic hip screws for fixation of intertrochanteric fractures of femur: A meta-analysis. *Orthopaedics & Traumatology: Surgery & Research*. 2014;100(8):859–866.
 6. Bojan AJ, Beimel C, Taglang G, Collin D, Ekholm C, Jönsson A. Critical factors in cut-out complication after gamma nail treatment of proximal femoral fractures. *BMC Musculoskeletal Disorders*. 2013;14:1.
 7. Parker MJ, Handoll HHG. Intramedullary nails for extracapsular hip fractures in adults. *Cochrane Database of Systematic Reviews*. 2006;3:CD004961.
 8. Hesse B, Gächter A. Complications following the treatment of trochanteric fractures with the gamma nail. *Archives of Orthopaedic and Trauma Surgery*. 2004;124(10):692–698.
 9. Horner NS, Samuelsson K, Solyom J, Björgul K, Ayeni OR, Östman B. Implant-Related Complications and Mortality After Use of Short or Long Gamma Nail for Intertrochanteric and Subtrochanteric Fractures: A Prospective Study with Minimum 13-Year Follow-up. *JBJS Open Access*. 2017;2(3):e0026.
 10. McConnell T, Tornetta P, Benson E, Manuel J. Gluteus medius tendon injury during reaming for gamma nail insertion. *Clinical Orthopaedics and Related Research*. 2003;(407):199–202.
 11. Bowers TM, Parker MJ. Assessment of outcome after hip fracture: development of a universal assessment system for hip fractures. *SICOT-J*. 2016;2:27.
 12. Yan D, Soon Y, Lv Y. Proximal femoral nail antirotation versus Gamma nail in treatment of femoral trochanteric fractures. *Current Orthopaedic Practice*. 2012;23(4):346