



## Comparative Analysis Of Clinical And Radiological Outcomes In Intertrochanteric Fractures Treated With Gamma Nail Versus Double Screw Proximal Femoral Nail (Pfn): A Prospective Cohort Study

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### Abstract

**Background:** Falls among older adults are a prevalent issue, contributing to morbidity and disability. Hip fractures, especially intertrochanteric fractures, are a serious consequence, demanding effective management strategies. This study compares clinical and radiological outcomes of intertrochanteric fractures treated with Gamma Nail and double screw PFN, considering the unique context of Dr. RPGMC Kangra.

**Methods:** An open cohort, prospective study enrolled 50 patients with stable intertrochanteric fractures. Surgical interventions using Gamma Nail and double screw PFN were performed at the Department of Orthopaedics, Dr. RPGMC Kangra. The study assessed demographics, surgery details, intraoperative blood loss, and postoperative outcomes. Statistical analysis employed SPSS version 22, with significance set at  $p < 0.05$ .

**Results:** Patients (mean age 70.82 years) predominantly fell in the 66-75 age group. PFN surgeries exhibited longer operative times and higher intraoperative blood loss than Gamma Nail. Clinical outcomes, including mobility scores and postoperative pain, favored PFN. No significant difference in fracture union rates was observed. Complications were minimal, with one case of lag screw migration in the Gamma Nail group.

**Conclusion:** The study suggests potential advantages of PFN in terms of reduced social dependency and postoperative pain. However, longer operative times and higher blood loss are noteworthy considerations. These findings contribute to the ongoing discourse on optimal approaches for treating proximal femur fractures. Larger-scale trials are warranted to validate these observations and guide evidence-based clinical decisions.

**Keywords:** Intertrochanteric fractures, Gamma Nail, Proximal Femoral Nail (PFN), clinical outcomes, radiological outcomes, surgical complications, postoperative rehabilitation

### Introduction

Falls among older adults are a common and complex phenomenon, resulting from a combination of predisposing and precipitating factors. The prerequisites for normal gait involve intricate neural networks, musculoskeletal structures, and sensory processing. Aging leads to a decline in these functions, increasing the risk of falls, especially on irregular surfaces. Falls are a major cause of morbidity and disability in the elderly, with

approximately one-third of individuals over 65 experiencing a fall each year.<sup>1</sup>

The consequences of falls are significant, with nearly 10% resulting in major injuries like fractures, soft tissue damage, or traumatic brain injuries. Hip fractures, a serious consequence of falls, are particularly prevalent among the elderly, contributing to increased morbidity and mortality. Falling without serious injury still poses risks, including a threefold

increase in the likelihood of skilled nursing facility placement, while serious fall injuries raise this risk tenfold.<sup>2</sup> Hip fractures, especially intertrochanteric fractures, account for a substantial portion of hospitalizations among trauma cases, affecting individuals aged 50 and older. The incidence of hip fractures is rising, with an estimated 280,000 fractures annually, expected to increase to 500,000 by 2040. These fractures are associated with significant morbidity and mortality, occupying over 20% of orthopedic ward bed occupancy and 87% of the total cost of fragility fractures.<sup>3</sup>

Various classifications exist for intertrochanteric fractures, with stable and unstable patterns. Unstable fractures, often associated with complications and high failure rates, present challenges in management. Surgical fixation is the standard approach, with options like sliding hip screws, intramedullary nails, or prostheses. The choice of implant depends on factors such as fracture pattern, age, and comorbidities.<sup>4</sup>

Postoperative rehabilitation is crucial, aiming to enhance muscle strength, walking safety, and overall independence. Reduced muscle strength post-surgery may lead to decreased walking capacity and increased vulnerability to falls. Early mobility is essential to prevent complications associated with immobility.<sup>5</sup>

Fear of falling and impaired balance are significant risk factors for falls, with studies linking chronic musculoskeletal pain, joint group involvement, and white-matter lesions to increased fall risk. Hospitalization itself increases the risk of falling, with adverse effects on older adults' vulnerability.<sup>6</sup>

This study focuses on comparing the clinical and radiological outcomes of intertrochanteric fractures fixed with Gamma Nail versus double screw Proximal Femoral Nail (PFN). Surgeons at Dr. RPGMC Kangra have been using double screws PFN for most intertrochanteric fractures, occasionally employing Gamma Nail. The hilly terrain and high frequency of these fractures in the region provide a unique context for exploring the efficacy of these techniques.<sup>7</sup>

## Materials and Methods

**Study Area:** This investigation was conducted at the Department of Orthopedics, Dr. R.P.G.M.C. Kangra, Tanda, Himachal Pradesh.

**Study Design:** An open cohort, prospective study design was employed.

**Study Population:** Patients undergoing surgical intervention in the Department of Orthopaedics, specifically using Gamma Nail and double screw PFN for extra-capsular femoral fractures.

**Study Duration:** Recruitment spanned one year, enrolling patients meeting the inclusion criteria.

**Sample Size:** A total of 50 consecutive patients with stable intertrochanteric fractures (AO 31A1.1, 31A1.2, and 31A1.3) were included.

### Inclusion Criteria:

Patients undergoing surgery for stable extracapsular proximal femur fractures (AO 31A1.1, 31A1.2, and 31A1.3).

Consent for inclusion in the study.

### Exclusion Criteria:

1. Patients with preoperative comorbidity in the fractured hip.
2. Fracture neck femur, hip fracture with dislocation, ipsilateral fracture shaft of femur, unstable inter-trochanteric fractures (AO 31A2 and AO 31A3), and open hip fractures.
3. Lack of consent for study participation.

**Ethical Justification:** The study received approval from the Institutional Ethics Committee, Dr. RPGMC Kangra, Tanda, and patients retained the right to withdraw.

**Preoperative Protocol:** Following ethical clearance, enrolled patients underwent detailed assessments, including demographic data, history, physical examinations, blood investigations, X-rays, and, if needed, CT scans. Patients were optimized for surgery, received counseling, and underwent COVID-19 screening.

**Operative Steps:** Patients received prophylactic antibiotics, and fractures were reduced under C-arm guidance. Surgical steps included small incisions, guide wire insertion, reaming, nail insertion, and

distal screw locking. Parameters such as surgery time, blood loss, and complications were noted.

**Post-operative Rehabilitation:** Rehabilitation included elevation, gradual weight-bearing, and physiotherapy. Sutures were removed, and patients were discharged based on clinical progress.

**Follow-Up:** Patients were followed up at 2 weeks, 6 weeks, 3 months, 6 months, and 12 months. Assessments included wound condition, X-rays, union status, complications, weight-bearing, and compliance to rehabilitation.

**Outcome Assessment:** Outcome measures included Pain, Mobility, and Social Dependency Scales. Comparison between groups fixed with double screw PFN or Gamma Nail was based on AO classification.

**Statistical Analysis:** Data, entered in Microsoft Excel, underwent analysis using SPSS version 22. Quantitative variables were expressed as means and standard deviations. Unpaired t-tests were employed for group comparisons, with significance set at  $p < 0.05$ .

**Results**

**Table 1: Group wise distribution of the patients**

Surgery	No of Cases	Percentage
CRIF with Gamma Nail	25	50.0
CRIF with PFN	25	50.0
Total	50	100.0

**Table 2: Age wise description of the patients**

Age Interval	No of Cases	Percentage
25-35 Year	3	6.1
36-45 Year	1	2.0
46-55 year	4	8.2
56-65 Year	8	14.3
66-75 Year	15	30.6
76-85 Year	11	22.4
>85 Year	8	16.3
Total	50	100.0
<b>Mean± SD (in years)</b>	<b>70.82±16.19</b>	

Out of 50 patients, there were 23 males and 27 females with male to female ratio of 1:1.22.

**Table 3: Gender wise distribution of the patients.**

Sex	No of Cases	Percentage
Female	27	55.1
Male	23	44.9
Total	50	100.0

Ratio

23:27

Out of 23 males, 12 patients were enrolled in CRIF with gamma nail group and 11 patients underwent CRIF with PFN, whereas out of 27 females, 13 patients underwent CRIF with gamma nail and 14 females underwent CRIF with PFN.

**Table 4: Comparison of intraoperative blood loss depending on the type of surgery conducted.**

Blood loss during surgery	CRIF with Gamma Nail	CRIF with PFN	P value
	n(%)	n(%)	<0.001
10-20 ml	1 (4.2%)	0	
15-20 ml	7(29.2%)	0	
18-20 ml	1 (4.2%)	0	
20 -30ml	1(4.2%)	0	
20-25 ml	1(4.2%)	0	
20-30 ml	8 (29.2%)	0	
30-35 ml	3 (12.5%)	0	
30-40 ml	1(4.2%)	5 (20%)	
40-50 ml	2 (8.3%)	7 (28%)	
50-60 ml	0	9 (36%)	
60-70 ml	0	3 (12%)	
80-90 ml	0	1 (4%)	
<b>Grand Total</b>	<b>25</b>	<b>25</b>	

Overall, the average time taken to operate the patient was 47.3 (SD=16.22) minutes. On comparing the two groups operating time was significantly greater in the patients who had undergone CRIF with PFN compared to the patients who had undergone CRIF with gamma nail ( $p<0001$ ). The mean operating time in the patients undergoing CRIF with gamma nail was 33 (SD=6.5) minutes whereas the mean operating time in the patients undergoing CRIF with PFN was 61 (SD=10.3) minutes.

## Discussion

Proximal femur fractures pose routine challenges for trauma and orthopedic surgeons, often resulting in immobility and impediments to daily life. Surgical complications and medical issues further compound

the challenges, necessitating a comprehensive understanding by surgeons. In this study, we aimed to compare the outcomes of extra capsular femoral fractures fixed with a single screw versus a double screw Proximal Femoral Nail (PFN).<sup>8</sup>

The Gamma Nail, designed for intramedullary fixation of AO type 31A2/A3 hip fractures, has shown positive outcomes, but postoperative femoral shaft fractures remain a key implant-related complication, reaching rates of up to 12%. Fixation of complex femoral fractures using the Gamma Nail can lead to secondary rotation of the head-neck fragment, culminating in collapse at the fracture site and cut-out, representing characteristic device-related adverse events.<sup>9</sup>

To address these concerns, the PFN was designed with modifications aimed at overcoming the limitations of the Gamma device. The PFN features a smaller diameter and fluted tip to reduce bone stress, a single distal locking screw for dynamic or static locking to maintain construct stiffness, and a smaller dynamic screw inserted through the proximal femoral neck to prevent rotation of the head-neck fragment, reducing the incidence of implant cutout.<sup>10</sup>

In our study, the mean age of participants was 70.82 years, with a majority in the 66-75 age group, consistent with findings in similar studies. Most patients reported a history of falls on level ground, aligning with previous research indicating that falls are a common cause of femoral fractures.<sup>11</sup> Operative time was notably longer for PFN surgeries compared to Gamma Nail surgeries, consistent with some studies but not others. While our study did not find a significant difference in clinical outcomes related to intra-operative reduction, previous research indicates that the 125-degree varus Gamma Nail helps prevent varus collapse, contrasting with a higher incidence of screw cut-out and fracture site collapse in PFN cases with varus reduction.<sup>12</sup>

Intraoperative blood loss was significantly greater in PFN surgeries in our study, aligning with some previous research. Mobility scores favored PFN in our study, in line with findings by Han et al. Duration of hospital stay did not significantly differ between the two procedures, consistent with some studies but not all.<sup>13</sup>

The Social Dependency scale revealed a significant reduction in social dependency in PFN patients 12 weeks post-surgery, suggesting potential benefits in daily living activities. PFN patients also reported significantly less postoperative surgical site pain from the 5th postoperative day to 6 weeks, which contrasts with some studies but aligns with others. Fracture union rates did not significantly differ between Gamma Nail and PFN groups in our study. Complications were minimal, with only one observed in the Gamma Nail group, where the lag screw migrated into the hip joint.<sup>14</sup>

## Conclusion

In conclusion, our study suggests that PFN may offer advantages in terms of reduced social dependency and postoperative pain, albeit with longer operative

times and higher intraoperative blood loss compared to the Gamma Nail. These findings contribute to the ongoing discourse on optimal approaches for treating proximal femur fractures, considering various patient and surgical factors. Further research and larger-scale trials are warranted to validate these observations and guide evidence-based clinical decisions.

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