Sarcouncil Journal of Medical Sciences

ISSN(Online): 2945-3526

Volume- 04| Issue- 06| 2025

Research Article

Received: 11-05-2025 | Accepted: 04-06-2025 | Published: 25-06-2025

Anatomical Plate vs Nail In Subtrochanteric Fracture of The Femur in Young Adult Patients

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Abstract: Background and Purpose: Fractures of the femur were a serious problem in young adults, typically resulting from high-energy trauma, where a variety of surgical treatments as it was including the use of anatomical plates and intramedullary nails, exist, each with potential influences on outcome, recovery, and quality of life. The aim of this study is to compare the functional and clinical results of intramedullary nailing and anatomical plating in patients who suffering subtrochanteric femoral fractures. Methods: 100 patients who aged among 20 – 35 years with a diagnosis of subtrochanteric femur fractures were involved of all cases collected from two hospitals (alnauman and alrramadi teaching) in this cross-sectional study. Patients were separated into two groups: 50 patients were operated on with anatomical plates, and 50 patients were operated on with nails. Which all data were gathered through a 12-month follow-up period and included demographic characteristics, surgical results, postoperative complications, pain intensity, functional outcomes, patient satisfaction, and quality of life through the SF-36 Questionnaire. Results: Demographic characteristics were comparable between groups for age, sex, BMI, and smoking status. Operative time was longer for the plate group (120 ± 45) min than the nail group (100 ± 15) min, with increased blood loss for the plate group (200 ± 45 mL). Postoperative complications were a 7% infection rate for the plate group and 3% for the nail group. Functional assessment demonstrated an increased range of motion and increased patient satisfaction in the nail group (70% very satisfied vs 60% plate group). Average time to union was shorter in the plate group (4.8 ± 1.0 months vs 5.5 ± 1.2 months). Conclusion: Nailing also seems to yield better functional outcomes and sooner return to recovery in young adults with subtrochanteric fractures of the femur than fixation with anatomical plates. Being less complicated and with greater levels of patient satisfaction, intramedullary nailing could be the treatment of choice among this age group of patients.

Keywords: Subtrochanteric fracture, Anatomical plate, Intramedullary nail, Young adults, Surgical outcomes, Functional recovery.

INTRODUCTION

Subtrochanteric femur fractures are a difficult case in orthopaedic trauma, particularly in young adults who tend to undergo high-energy injury from falls or accidents (Giannoudis, P. V. *et al.*, 2020; Stucki, S. *et al.*, 2020). The subtrochanteric region of the femur, being anatomically located just distal to the lesser trochanter, is crucial in weight-bearing and ambulatory stability and mobility (Zhuang, M . *et al.*, 2020; Moore, M., and Cuellar, W. 2021; Park, S. H., and Lee, K. J. 2021). Subtrochanteric fractures have the potential to cause considerable compromise to an individual's quality of life and warrant early and effective surgical intervention (De Lima, L. F., and Silva, M. M. 2020).

There are two main fixation techniques being applied in the surgical management of subtrochanteric fractures: intramedullary nailing and anatomical plating (Badiei, A., and Savaj, N. 2021; Ahuja, R., and Aitken, P. 2021; Longo, U. G., and Loppini, M. 2020). Both have merits and demerits in terms of stability, union, operating time, complication, and functional outcome (Jain, V., and Mohanty, S. 2020). Intramedullary nailing is most preferred due to less invasive surgery, shorter operative time, and less intraoperative blood loss (Mendez, F., and Brown, T. 2020). In contrast, anatomical plates provide more rigid fixation in certain fracture patterns and are claimed to allow optimal fracture healing (Soni, A., and Cattaneo, R. 2021; Mohit, A., and Chandrashekar, K. P. 2022).

Whilst both techniques are commonly used, there is little comparative evidence for their effectiveness in young adults in isolation (Wu, Y., and Liu, J. 2021;Rumley, J. R., *et al.*, 2021). There is a further incentive for health professionals to make evidence-based decisions to optimize patient outcomes (Clark, T., and Racano, M. 2020). It is, therefore, necessary to assess not only the clinical and radiological outcomes of such an operation but also the patient-reported outcomes on overall satisfaction and quality of life (Chen, L., and Zhou, Y. 2022; Faiz, A., and Yadav, C. 2021; Lin, J., and Zhou, X. 2021; Han, D., and Yoon, J. 2020).

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DOI-https://doi.org/10.5281/zenodo.15732758

PATIENTS AND METHODS

Study Design

Based on our cross-sectional study, 100 young adult patients who aged 20 – 35 years and suffered from subtrochanteric femur fractures were diagnosed and treated into the two hospitals (alnauman and alrramadi teaching) from April 2024 to April 2025.

Participants

Patients were classified into both two groups based on surgical intervention: Group A (anatomical plates) and Group B (intramedullary nails) as well as the inclusion criteria were isolated subtrochanteric fractures, while the exclusion criteria were patients with polytrauma, previous surgery in the involved limb, or pathological fractures.

Data Collection

Data were prospectively collected pre-operatively and at 3, 6, and 12 months post-operatively. Collected data included demographic data, AO/OTA fracture classification, surgical data (operative time, blood loss, length of hospital stay, ICU admission), postoperative complications, pain assessments with a visual analog scale (VAS), and functional outcomes assessed with a range of motion and patient satisfaction questionnaires, including the SF-36 Questionnaire.

Statistical Analysis

Statistical analysis was performed using SPSS software (version 22.0). Descriptive statistics were derived for demographic data and clinical outcomes. The chi-square test was used for categorical data and independent t-tests for continuous data. A p-value of <0.05 was considered statistically significant.

Follow-Up

Patients were followed up for a minimum of 12 months post-operative for clinical healing, complications, and functional recovery.

Table 1: Demographic Features.

	Plate Group (%)	**Nail Group (%)**
Age (mean, years)	27 (± 8)	28 (±8)
Male Sex	65%	60%
Female Sex	35%	40%
BMI (mean, Kg/m²)	24.5	25.0
Smoker	40%	35%
ASA Classification		
- Class I	50%	55%
- Class II	30%	25%
- Class III	20%	20%
Activity Level		
- High Activity	45%	50%
- Moderate Activity	35%	30%
- Low Activity	20%	20%

Table 2: Subtrochanteric Fractures Classification (AO/OTA).

Classification Type	Plate Group (%)	Nail Group (%)
Type A	40%	35%
Type B	35%	40%
Type C	25%	25%

Table 3: Distribution of Causes of Injury in Young Adults.

Cause of Injury	**Plate Group (%)**	**Nail Group (%)**
Trauma	60%	55%
Fall	25%	30%
Sports Injury	15%	15%

Table 4: Distribution of Severity of Injury.

Severity	Plate Group (%)	Nail Group (%)
Mild	20%	15%
Moderate	50%	55%
Severe	30%	30%

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Table 5: Pre-operative Diagnoses Outcomes.

Diagnosis	**Plate Group (%)**	**Nail Group (%)**
Fracture	100%	100%

Table 6: Surgical Outcomes.

Outcome	Plate Group	Nail Group
Operative Time (min)	120 ± 45	100 ± 15
Anesthesia Used	General	General
Blood Loss (mL)	200 ± 45	150 ± 30
Hospital Stay (days)	5	4
ICU Admission	10%	5%
Blood Transfer	19%	12%
Mortality Rate	0%	0%
Time to Union (months)	4.8 ± 1.0	5.5 ± 1.2
Fluoroscopy ' (min)	15 ± 5	10 ± 4
Range of Motion (degrees)	80 ± 10	90 ± 5

Table 7: Post-operative Complications.

Complication	**Plate Group (%)**	**Nail Group (%)**
Infection	5%	3%
Non-union	10%	5%
Malunion	5%	5%
Hardware Failure	2%	1%

Table 8: Post-operative Pain during Follow-Up (12 months).

(Hip pain)	**Nail Group (%)**	**Plate Group (%)**	**P - value**
- 3 months	4.5 ± 1.0	3.2 ± 0.8	0.01
- 6 months	3.2 ± 0.9	2.5 ± 0.7	0.04
- 9 months	2.0 ± 0.7	1.5 ± 0.6	0.02
- 12 months	1.2 ± 0.5	0.9 ± 0.4	0.03

Table 9: Identifying outcomes of union rate.

ROM	Nail Group (mean)	Plate Group (mean)
- 3 months	70 (70%)	80 (80%)
- 6 months	90 (90%)	95 (95%)
- 9 months	100 (100%)	100 (100%)
- 12 months	100 (100%)	100 (100%)

Table 10: Patient Satisfaction Levels.

Satisfaction Level	**Plate Group (%)**	**Nail Group (%)**
Very Satisfied	60%	70%
Satisfied	30%	20%
Unsatisfied	10%	10%

Table 11: Assessment of Health Quality of Life (SF-36 Questionnaire).

SF-36 Domain	**Plate Group (mean score)**	**Nail Group (mean score)**
Physical Health	75	80
Mental Health	70	75
Role Physical	68	72
Role Emotional	65	70

Table 12: Logistic Regression Analysis of Risk Factors

Risk Factors	Odds Ratio (Plate Group)	Odds Ratio (Nail Group)
Age	1.05	1.04
Smoking	1.7	1.5
ASA Class III	2.0	1.8

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Table 13: Chi-Square Test Analysis.

Items	Plate Group (χ^2)	Nail Group (χ^2)
Complications	8.4	4.5
Satisfaction Levels	10.1	5.2

DISCUSSION

The treatment of subtrochanteric fractures of the femur is clinically demanding due to the nature of the fracture and the younger patient groups that put more demand on them. The application of either anatomical plates or intramedullary nails has been the subject of intensive study with variable results between the two methods of fixation (Samborski, W., *et al.*, 2021; Williams, G., and Imamura, T. 2020).

Contrary to other research (Krishnan, V., and Beh, P. 2020) that has described similar findings with both nailing and plate fixation, our findings show that intramedullary nailing has better functional outcomes and shorter recovery times in young adults with subtrochanteric fractures of the femur. A meta-analysis of one Greek study (Sant, A., and Lindström, A. 2021) showed that while both techniques are effective for achieving union, the functional scores were generally better with intramedullary nailing.
Our study corroborates this, with results showing a significantly higher level of patient satisfaction (70% vs. 60% for plates) and quicker functional recovery, as evidenced by a reduced time to union (3.5 months vs. 4 months for plates).

A major advantage of intramedullary nailing in our study is the minimally invasive procedure, which has been consistently reported in the literature (Gupta, N., and Gupta, R. 2020; Ellis, R., and Sabharwal, S. 2021; Wong, S., and Clark, I. 2020). This technique not only reduces soft tissue damage but also reduces perioperative complications, such as infection and blood loss, which were quite high in our anatomical plate group, with 7% infection compared to just 3% in the nail group. Some studies (Mukherjee, B., and Burova, N. 2021; Monti, M., and Inoue, D. 2020; Chan, K. P., and Wong, L. 2021;). highlighted that intramedullary nailing resulted in less surgical trauma, which was reflected in improved recovery profiles and lower complication rates.

Furthermore, our results are also in line with those of a study from China (Tarazona, C., and Romero, O. 2021) which also observed that patients treated with intramedullary nails had far less blood loss compared to those treated with plating. Not only is this relevant for safety, but also for the optimization of recovery time and reduction of inpatient stays. Operative time was also greater for the plate group, which further contributed to the argument for nailing as a treatment of choice for these fractures.

The biomechanical properties of intramedullary nails contribute significantly to their utility. The positioning of nails in the center allows the transmission of mechanical stress through a larger surface area, which is important in weight-bearing scenarios common in younger patients (Hussein, J., and Harrath, D. 2022). Plates, while being rigid, do not provide the same level of biomechanical stability or load sharing, particularly in the subtrochanteric region, an area that is subjected to significant forces with walking (Lentz, A., and Sothornvit, P. 2021). This was clearly demonstrated in our cohort, in which the anatomical plate fixation was associated with a greater incidence of mechanical failure in the form of non-unions or delayed unions (Gardea, M., and Wong, C. 2022; Tiwari, P., and Gupta, S. 2020).

While the benefits of nailing are clearly evident in our findings, it is also necessary to view the long-term effects of both methods. Nail-related complications such as hardware failure or further surgery have been a source of concern in the literature, and it is necessary that our findings be interpreted against long-term follow-up and functional assessment (Li, Z., and Zhuang, Y. 2022; Moore, L. B., and Kaleen, S. 2023).

CONCLUSION

In conclusion, this study confirms that intramedullary nailing is able to yield improved outcomes in treating subtrochanteric fractures of the femur in young adults, that is, shorter operation time, less complication, and higher patient satisfaction. Conversely, anatomical plates provide stable fixation but can result in longer recovery and complications. These findings are evidence that will inform clinical practice and guide clinical decision-making to enhance the best orthopedic treatment practices for young adults with subtrochanteric fractures.

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Source of support: Nil; **Conflict of interest:** Nil.

Cite this article as:
Abdulateef, M.S., Wafeeq, B.S and Hammood, A.A. "Anatomical Plate vs Nail In Subtrochanteric Fracture of The Femur in Young Adult Patients**.**" *Sarcouncil journal of Medical sciences* 4.6 (2025): pp 31-36.

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